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FloBoss™ 103 and 104 Flow Manager Instruction Manual

FloBoss 103

FloBoss 104

Remote Automation Solutions

EMERSON™
Process Management

Revision Tracking Sheet

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Chapter 1 – General Information

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This manual focuses on the hardware aspects of the FloBoss™ 103 and FloBoss 104 Flow Managers, referred to generically within this manual as "the FB100-Series" or "the FB100". For information about the software used to configure these devices, refer to the *ROCLINK™ 800 Configuration Software User Manual* (Part D301159X012).

This chapter details the structure of this manual and provides an overview of the FB100-Series and its components.

1.1 Scope of Manual

This manual contains the following chapters:

Chapter 1 General Information	Provides an overview of the hardware and specifications for the FB100.
Chapter 2 Installation and Use	Provides information on installation, tools, wiring, and mounting the FB100.
Chapter 3 Power Connections	Provides information on connecting the FB100 to a DC or solar panel power source.

Chapter 4 Input/Output	Provides information on the various I/O capabilities of the FB100.
Chapter 5 Communications	Provides information on the communications capabilities of the FB100.
Chapter 6 Dual-Variable Sensor	Provides information on the dual-variable sensor that provides static and differential pressure inputs.
Chapter 7 Pulse Interface Module	Provides information on the pulse interface module that provides pressure and pulse inputs.
Chapter 8 Calibration	Provides instructions on calibrating AI, RTD, and DVS inputs.
Chapter 9 Troubleshooting	Provides information on diagnosing and correcting problems for the FB100.
Glossary	Provides a general listing of acronyms and terms.
Index	Provides an alphabetic listing of items and topics contained in this manual.

1.2 Product Overview

The FB100-Series—whether the FB103 or FB104—is a 32-bit microprocessor-based electronic flow computer. The FB100 electronically measures, monitors, and manages gas flow for a single meter run using orifice plate, rotary meter, or turbine meter techniques. This economical flow computer reliably and accurately performs gas flow calculations, temperature measurements, data archival, and remote communications with an optional communications card installed.

Note: Any functional differences between the FB103 and FB104 are noted in the text.

The FB100 performs minute, hourly (periodic), daily, and minimum / maximum historical data archivals for standard history and a configurable time interval archival for extended history. The FloBoss 103 is the perfect solution to electronically replace traditional paper charting. The FB100 records the corrected gas flow across an orifice plate or meter, stores the data, and has the ability to send the data to a remote host.

The FB100 computes gas flow for both volume and energy. It provides on-site functionality and supports remote monitoring, measurement, data archival, communications, and control. The design of the FB100 allows you to configure specific applications, including those requiring logic and sequencing control using a Function Sequence Table (FST).

Note: For further information on FSTs, refer to the *Function Sequence Table (FST) User Manual* (part D301058X012).

1.2.1 Components and Features

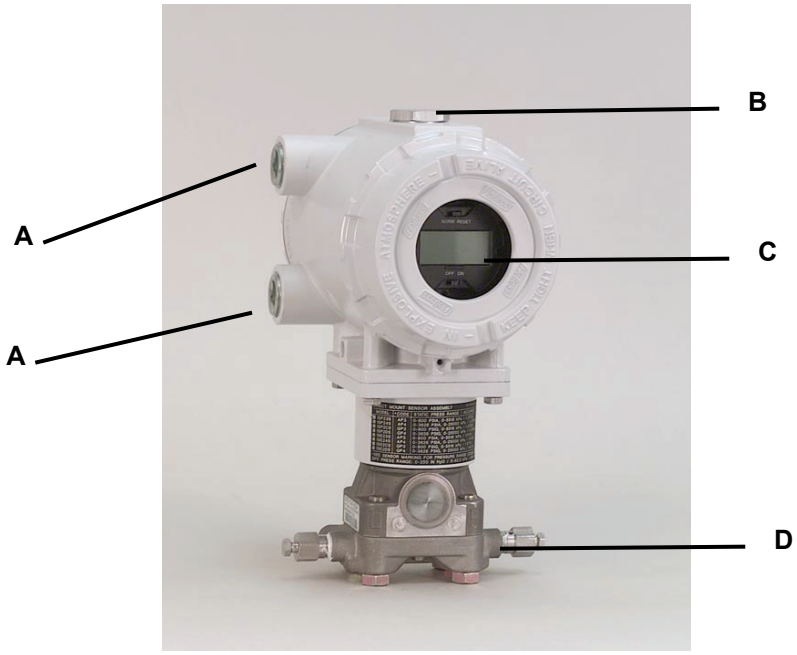
The FB100 provides the following components and features:

- Weather-tight enclosure
- Termination printed circuit board ("Termination module")
- 32-bit processor print circuit board ("Processor module")
- Battery charger printed circuit board. ("Battery Charger module")
- Backplane printed circuit board
- 2 MB of field-upgradeable flash ROM (Random Access Memory)
- 512 KB of battery backed-up RAM (Random Access Memory) storage
- Integral Dual-Variable Sensor (DVS, available on the FB103) for static pressure and differential pressure measurement using orifice metering
- Pulse Interface module (available on the FloBoss 104) for line pressure and pulse counts using turbine or rotary metering
- Support for a three-wire 100-ohm Resistance Thermal Detector (RTD) input
- Internal lead-acid batteries (optional)
- Solar panel mast assembly
- Local Operator Interface (LOI) port – EIA-232 (RS-232)
- EIA-485 (RS-485) on Comm 1 port
- Communications module using EIA-232 (RS-232), EIA-485 (RS-485), or dial-up modem
- Extensive applications firmware

Refer to each component's Product Data Sheets for the approvals options for hazardous locations.

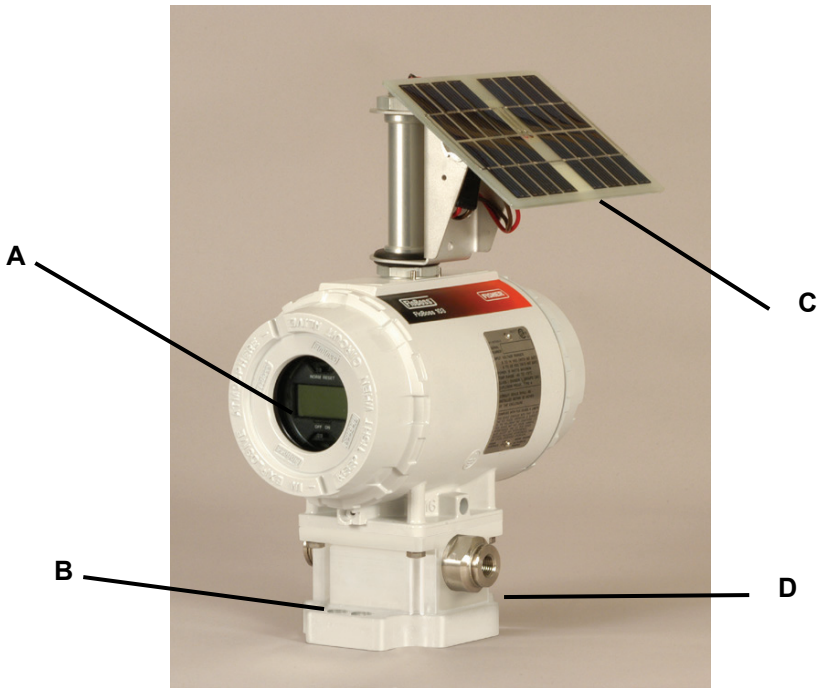
Physical Configuration

Physically, the FB100 consists of a termination module with optional I/O points, RAM battery backup board, optional Comm 2 communications module, processor module, battery charger module, backplane, and optional display housed in a compact, weather-tight case. The FB100 is packaged in a NEMA 4 windowed enclosure that mounts on a pipestand, to an orifice plate via a 3- or 5-valve manifold, to a turbine meter, or to a rotary meter. The aluminum alloy enclosure protects the electronics from physical damage and harsh environments. Refer to *Figures 1-1* and *1-2*.



A Field conduit entry
B Optional solar panel mounts here
C Liquid crystal display (LCD)
D Dual variable sensor (DVS)

Figure 1-1. FloBoss 103 Flow Manager with LCD



A Liquid crystal display (LCD)
B Pulse interface module
C Optional solar panel
D Pressure transducer

Figure 1-2. FloBoss 104 Flow Manager with Solar Panel

The enclosure is fabricated from die-cast aluminum alloy with iridite plating and paint. The NEMA 4 enclosure protects the electronics from physical damage and harsh environments. The caps at either end of the enclosure unscrew to allow field maintenance. Two ¾-14 pipe-threaded holes permit field conduit wiring and communications.

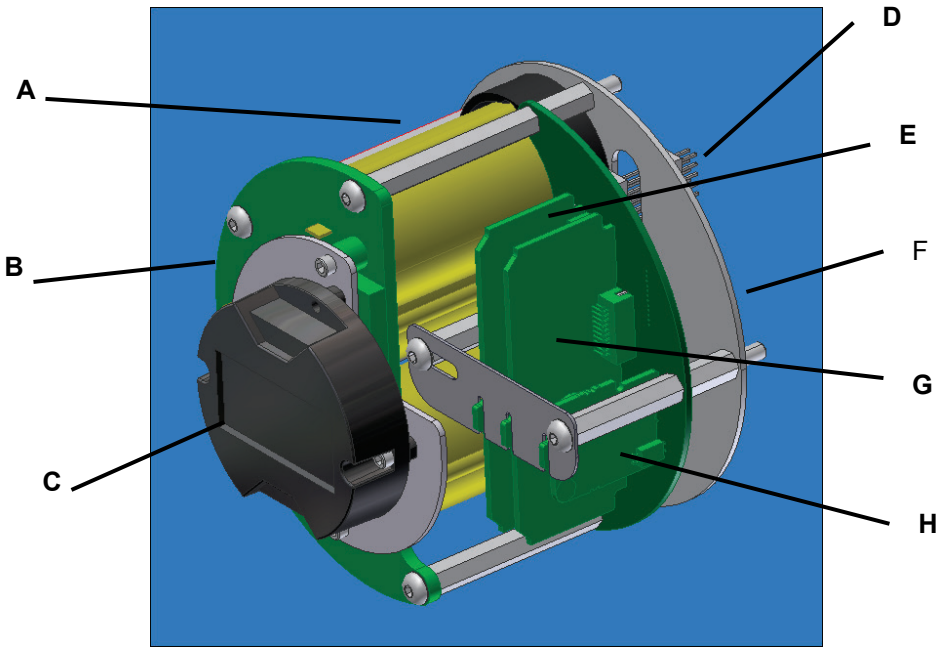
The DVS flange (available on the FB103) has bracket holes that allow the enclosure and DVS to be mounted on a pipestand or mounting bracket. The Pulse Interface module (available on the FloBoss 104) has a universal mounting plate that also has bracket holes that allow you to mount the enclosure and Interface on a meter.

1.2.2 Hardware

This section discusses the hardware components of the FB100.

Backplane

The backplane printed circuit board regulates power and routes signals to the termination module, the processor module, the backup battery board, the optional communications module, the Dual-Variable Sensor (DVS, available on the FB103), the Pulse Interface module (available on the FB104), and the battery charger module. Refer to *Figure 1-3*.

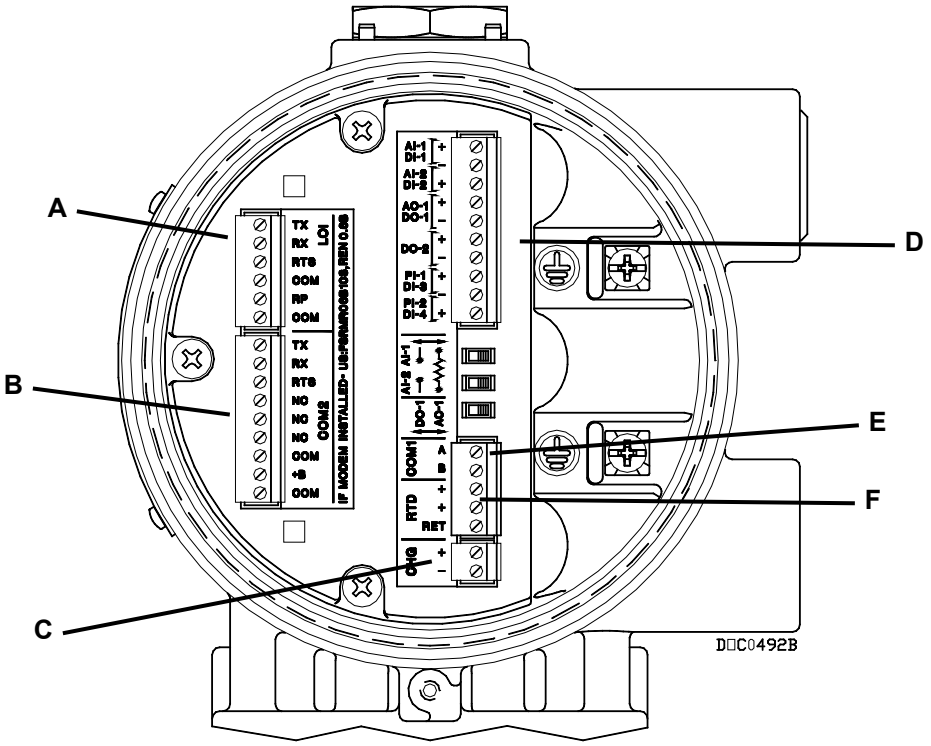


A Battery pack (if ordered)
B Battery Charger module
C Optional liquid crystal display (LCD)
D Termination board connectors
E Processor module
F Backplane
G Optional communications module
H RAM backup

Figure 1-3. Inside the FB100-Series Enclosure

Termination Module

Located in the terminal side of the explosion-proof housing, the termination module provides connections to the field wiring. Refer to *Figure 1-4*.



A Local operator interface (LOI)
B COM2
C Power supply
D I/O field wiring
E LOI (COM1)
F RTD

Figure 1-4. Wiring Terminals

Connections include the power supply, Local Operator Interface (LOI) communications, Comm 1 (for EIA-485 [RS-485] communications), optional Comm 2 (for EIA-232 [RS-232], wireless spread-spectrum radio, or dial-up modem communications), RTD wiring, and the I/O field wiring.

The termination board provides surge and static discharge protection for the field wiring. Electronics include the RTD circuits and the final I/O drivers/receivers. The termination board also serves as an interface to the backplane board in the electronics portion of the enclosure.

Processor Module

The 32-bit processor module (see *Figure 1-3*) contains the processor, memory (static RAM, Flash EEPROM, and boot ROM), Local Operator Interface (LOI) EIA-232 (RS-232) communications driver, Comm 1 EIA-485 (RS-485) communications driver, the reset controller, and the real-time clock.

The processor module (also called the central processor unit or CPU) provides the Serial Peripheral Interface (SPI) bus; the Liquid Crystal

Display (LCD) drivers; and controls for the Dual-Variable Sensor (DVS), the Pulse Interface module, and the optional I/O termination points.

The microprocessor has low-power operating modes, including inactivity and low battery condition. The FB100 comes standard with 512 KB of built-in, static random access memory (SRAM) for storing data and history. The FB100 also has 2 MB of programmable read-only memory (flash ROM) for storing operating system firmware, applications firmware, and configuration parameters.

Battery Charger Module

The battery charger module controls charging of the internal batteries, if installed. The batteries are three D-size lead-acid batteries providing 2.5 Amp-hours of current at 6.2 volts nominal. The battery charger board also serves as the interface to the optional LCD assembly, as well as supporting the On/Off and Norm/Reset jumpers.

A backup battery provides backup power for the static RAM and the real-time clock. This battery is field replaceable and under normal conditions has a functional life in excess of five years.

Dual-Variable Sensor (DVS)

The Dual-Variable Sensor (DVS, available on the **FB103**) measures static pressure and differential pressure for orifice flow calculation by converting the applied pressure to electrical signals and making the readings available to the processor board.

The DVS housing fastens to a flanged adapter, which, in turn, mounts with four bolts to the bottom of the enclosure (see *Figure 1-1*). The DVS cable connects into the backplane board. Refer to *Chapter 6, Dual-Variable Sensor*.

Pulse Interface Module

The Pulse Interface module (available on the **FB104**) measures the flow of natural gas using turbine metering or rotary metering by converting the applied pressure to electrical signals and counting the number of pulses (from rotary meter) and making the readings available to the processor board.

The module housing fastens to a flanged adapter, which, in turn, mounts with four bolts to the bottom of the enclosure (see *Figure 1-2*). A cable connects the module into the backplane board. Refer to *Chapter 7, Pulse Interface Module*.

Resistance Temperature Detector (RTD)

An RTD temperature probe typically mounts in a thermowell on the meter run. The RTD measures the flowing temperature. Protect RTD wires either by a metal sheath or by conduit connected to a liquid-tight conduit fitting on the enclosure.

The RTD wires connect directly to the RTD connector on the termination board inside the enclosure (see *Figure 1-4*). Refer to *Chapter 4, Input/Output*.

The built-in inputs and outputs (I/O) on the FB100-Series (see *Figure 1-4*) consist of a 2- or 3-wire 100-ohm Resistance Temperature Detector (RTD) input interface and a port for either a Dual-Variable Sensor

(DVS) or a Pulse Interface module. Three diagnostic analog inputs (AI) monitor the battery voltage, logical voltage, and enclosure/battery temperature. Refer to *Chapter 4, Input/Output*.

Communications

The Local Operator Interface (LOI) port provides a direct, local link between the FB100-Series and a PC through a Local Operator Interface cable using EIA-232 (RS-232) communications.

The Comm 1 allows EIA-485 (RS-485) serial communication protocols.

The optional communications card for EIA-232 (RS-232), EIA-485 (RS-485), or dial-up modem activate Comm 2. Refer to *Chapter 5, Communications*.

ROCLINK 800 Configuration Software

The PC-based ROCLINK 800 configuration software enables you to configure and access the I/O parameters, DVS inputs, flow calculations, power control, security, and FST programs. Refer to the *ROCLINK 800 Configuration Software User Manual* (Part D301159X012) for details concerning software capabilities.

The PC communicates with the FB100-Series through an LOI cable using EIA-232 (RS-232) communications.

1.2.3 Firmware

The firmware contained in flash ROM on the processor module determines the functionality of the FB100 and includes:

- 1992 AGA-3 flow calculations (with user-selectable AGA8 compressibility Detail, Gross I, or Gross II) for a single meter run
- 1996 AGA-7 flow calculations (with user-selectable AGA8 compressibility) for a single meter run.
- Memory logging of 240 alarms and 240 events
- Archival of minute data from the last 60 minutes for up to 35 points (Standard History)
- Archival of 35 days of hourly data for up to 35 points (Standard History)
- Archival of 35 days of daily data for up to 35 points (Standard History).
- Archival of Min / Max historical data for today and yesterday (Standard History)
- Archival of 5040 entries for up to 15 points at user-specified interval (Extended History)
- Power control (wake up on ring) on optional internal modem
- Logic and sequencing control using a user-defined Function Sequence Table (FST)
- Closed-loop (PID) control capabilities (requires optional I/O termination points)
- Communications based on the ROC protocol or Modbus slave, or optional host, (ASCII or RTU) protocol for use with EFM applications

- Alarm call-in to host for Spontaneous-Report-By-Exception (SRBX)
- User-level security.

1.2.4 Options and Accessories

The FB100 supports the following options and accessories:

- Communication modules for either EIA-232 (RS-232), EIA-485 (RS-485), dial-up modem
- 6 Input/Output (I/O) termination points
- Local Operator Interface (LOI) cable
- Liquid Crystal Display (LCD) with two-line alpha-numeric viewing
- Solar panel mast assembly
- Blank plate for the FB103 for use when no DVS is required

Plug-in communication modules allow you to customize the FB100 installation for most communication requirements. Optional communication cards provide the ability to send and receive data.

The housing accommodates **one** of the following modules:

- EIA-232 (RS-232) or EIA-485 (RS-485) for asynchronous serial communications
- Dial-up modem for communications over a telephone network

Liquid Crystal Display (LCD)

The optional Liquid Crystal Display (LCD) enables you to view data and configuration parameters while on site without using the local operator interface (LOI) and a PC. The LCD display plugs into the battery charger board and is visible through the window on the front of the FB100-Series. The LCD can be rotated 90° in either direction.

The LCD's 2-line display shows one line for a value and the other line for a 5-character alphanumeric description of the value. The display operates from the internal 3.3 Volt supply. Through this display, you can view predetermined information stored in the FB100. You can define up to 16 items for display. Every three seconds the display automatically cycles through the configured list of items.

Solar Panel

You can install an external solar panel to recharge the backup batteries. The panel connects to the CHG+ / CHG- inputs on the termination board. An integral solar panel (2 W or 5 W, available from Remote Automation Solutions) connects directly to the battery charger board assembly. Circuitry on the battery charger board monitors and regulates the charge based on battery voltage, charging voltage, and temperature. The FB100-Series requires a minimum 8-volt 200 mA solar panel.

The optional input/output (I/O) termination points provide additional inputs and outputs for expanded monitoring and control applications. I/O includes analog input (AI), analog output (AO), discrete input (DI), discrete output (DO), and pulse input (PI). The DO circuitry is optically coupled to help isolate the processor board from the output device. I/O can be used to drive a sampler or odorizer, open a valve, or monitor an additional analog input.

1.2.5 FCC Information

This equipment complies with Part 68 of the FCC rules. Etched on the modem assembly is, among other information, the FCC certification number and Ringer Equivalence Number (REN) for this equipment. If requested, this information must be provided to the telephone company.

This module has an FCC-compliant telephone modular plug. The module is designed to be connected to the telephone network or premises' wiring using a compatible modular jack that is Part 68-compliant.

The REN is used to determine the quantity of devices that may be connected to the telephone line. Excessive RENs on the telephone line may result in the devices not ringing in response to an incoming call. Typically, the sum of the RENs should not exceed five (5.0). Contact the local telephone company to determine the total number of devices that may be connected to a line (as determined by the total RENs).

If this equipment and its dial-up modem causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. However, if advance notice is not practical, the telephone company will notify the customer as soon as possible. In addition, you will be advised of your right to file a complaint with the FCC if you believe it necessary.

The telephone company may make changes to its facilities, equipment, operations, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice so you can make the necessary modifications to maintain uninterrupted service.

If you experience trouble with this equipment or the dial-up modem, contact Remote Automation Solutions TechSupport (at 641-754-3923) for repair or warranty information. If the equipment harms the telephone network, the telephone company may request that you disconnect the equipment until the problem is resolved.

1.3 Product Functions

This section describes the functions of the FB100-Series, most of which are determined by firmware and are configurable using ROCLINK 800. The features and applications include:

- Flow calculations for an orifice meter (AGA3) or rotary or turbine meter (AGA7)
- Extensive historical data archival
- Memory logging of 240 alarms and 240 events
- Security with local and remote password protection
- Logic and sequencing control using a user-defined FST program
- Spontaneous-Report-by-Exception (SRBX) capability

1.3.1 Flow Measurement

The primary function of the FB100-Series is to measure the flow of natural gas through an orifice or turbine or rotary meter in accordance with the 1992 American Petroleum Institute (API) and American Gas Association (AGA) standards.

The primary inputs used for AGA3 flow measurement function are differential pressure, static pressure, and temperature. The differential and static pressure inputs, which are sampled once per second, come from the Dual-Variable Sensor. The temperature input, which is sampled and linearized once per second, comes from an RTD probe.

The primary inputs used for AGA7 flow measurement are Pulse Input (PI) counts, static pressure, and temperature. The Pulse Input counts are acquired from a rotary meter (pulse interface module) or turbine meter (PI on termination board), the static pressure (including auxiliary pressure) inputs come from the pressure transducers, and the temperature input is read from an RTD probe.

Flow Calculations for Orifice Metering

The flow calculation is in accordance with ANSI/API 2530-92 (AGA Report No. 3 1992), API Chapter 14.2 (AGA Report No. 8 1992 2nd printing 1994), and API Chapter 21.1. The flow calculation may be configured for either metric or English units.

Flow Timer

The differential pressure stored for each second is compared to the configured low flow cutoff. If the differential pressure is less than or equal to the low flow cutoff or the converted static pressure is less than or equal to zero, flow is considered to be zero for that second.

Flow time for a recalculation period is defined to be the number of seconds for which the differential pressure exceeded the low flow cutoff.

Input and Extension Calculation

Each second the FB100-Series stores the measured input for differential pressure, static pressure, and temperature and calculates the Integral Value (IV). IV is the square root of the absolute upstream static pressure multiplied by the differential pressure.

The FB100-Series calculates flow time averages of the inputs and the IV over the configured calculation period, unless there is no flow for an entire calculation period. Linear averages of the inputs are recorded to allow monitoring during no flow periods.

Instantaneous Rate Calculations

The instantaneous value of the Integral Value (IV) is used with the previous calculation period's Integral Multiplier Value (IMV) to compute the instantaneous flow rate.

The IMV is defined as the value resulting from the calculation of all other factors of the flow rate equation not included in the IV. The instantaneous flow rate is used with the volumetric heating value to compute the instantaneous energy rate.

Flow and Energy

The averages of the differential and static pressure, temperature, and sum of the IV are used with the flow time to compute the flow and

Accumulation

energy over the calculation period. The flow and energy are then accumulated and stored at the top of every hour. At the configured contract hour, the flow and energy are then stored to the Daily Historical Log and zeroed for the start of a new day (contract hour).

Flow Calculations for Turbine Metering

The turbine flow calculation is in accordance with 1996 AGA Report No. 7 (1993 API Chapter 21.1). The FloBoss performs 1992 AGA8 compressibility calculations in accordance with AGA Report No. 8 1992 (API Chapter 14.2).

Once every scan period, the FB100 processes the pulse counts, determines the number of pulse counts since the last reading, and calculates a rate. Next, the static pressure and auxiliary pressure values are read. Then the temperature is read and linearizing compensation is applied to the pressure readings if necessary.

All resultant values are stored in the current value database. The values are taken from the current value database and used to calculate the Minute, Hour, and Daily historical values.

Once a minute and once an hour, the values are logged along with other configured values to the Historical Database. At the configured Contract Hour, the values are stored to the Daily Historical Log and zeroed for the start of a new day.

1.3.2 History Points

History is saved to 2 databases: Standard and Extended History. The number of entries/logs available to Standard and Extended History is configurable.

The Standard history archives up to 35 points (8 are pre-configured) of min/max, minute, hourly and daily values. The min/max values are from today and yesterday; the minute values are from the last 60 minutes; the hourly values are from the last 35 days; and the daily values are from the last 35 days.

The Extended History database creates one entry for up to 15 points at a user-specified interval (see Specifications table). All the points in the Extended History will be logged at the same interval.

The default setting for Extended history archives 4 points of 10-minute values (from the last 35 days). 10-minute archiving provides a monitoring resolution similar to a chart recorder.

The first eight history points are pre-configured for flow metering history and cannot be changed:

1. Flowing Minutes Today (Accumulate archive type).
2. Differential Pressure for AGA3 (Average) or Accumulated Raw Pulses for AGA7 (Totalize).
3. Static or Line Pressure (Average).
4. Flowing Temperature (Average).

5. IMV (Integral Multiplier Value) for AGA3 (Average) or BMV (Base Multiplier Value) for AGA7 (Average).
6. Pressure Extension for AGA3 (Average) or Today's Total for AGA7 (Totalize).
7. Instantaneous Flow (Accumulate).
8. Instantaneous Energy (Accumulate).

History Point 2 (AGA3), History Point 3, History Point 4, and History Point 6 (AGA3) are all pre-defined as an Average Archive Type that employs one of the following techniques:

- Flow dependent time-weighted linear averaging (default)
- Flow dependent time-weighted formulaic averaging
- Flow-weighted linear averaging
- Flow-weighted formulaic averaging

The Averaging Technique is selected by using ROCLINK 800 software. The selected Averaging Technique is applied to the meter inputs. Refer to the *ROCLINK 800 Configuration Software User Manual* (Part D301159X012).

Minute Historical Log

The FB100 has a 60-minute historical log for every history point. The Minute Historical Log stores the last 60 minutes of data from the current minute. Each history point has Minute Historical Log entries, unless the history point is configured for FST-controlled logging.

Hourly Historical Log

The FB100 has a total of 35 days of hourly historical logs available for every history point. The Hourly Historical Log is also called the periodic database. With two exceptions (FST Minute and FST Second logging), the system records the Hourly Log at the beginning of every hour.

The time stamp for periodic logging consists of the month, day, hour, and minute. The exception is for FST Second logging, in which the time stamp consists of the day, hour, minute, and second.

Daily Historical Log

The FB100 has a total of 35 daily historical logs for every history point. The Daily Log is recorded at the configured contract hour every day with a time stamp that is the same as the Hourly Log. Each history point has daily historical log entries, unless the history point is configured for FST-controlled logging.

Mix/Max Historical Log

The Min / Max database displays the minimum and the maximum values for the database points over a 24-hour period for today and yesterday. You can view the Min / Max historical log but not save it to disk.

Mix/Max Historical Log

The Min / Max database displays the minimum and the maximum values for the database points over a 24-hour period for today and yesterday. You can view the Min / Max historical log but not save it to disk.

Extended History Log

The FB100 has configurable archive times (1 minute to 60 minutes) which, in turn, determine the number of entries.

Alarm Log

The Alarm Log contains the change in the state of any alarm signal that has been enabled for alarms. The system Alarm Log has the capacity to maintain and store up to 240 alarms in a "circular" log. The Alarm Log has information fields that include time and date stamp, alarm clear or set indicator, and either the Tag name of the point or a 14-byte detail string in ASCII format.

In addition to providing functionality for appending new alarms to the log, the Alarm Log allows host packages to request the index of the most recently logged alarm entry. Alarm logging is available internally to the system, to external host packages, and to FSTs. Alarm Logs are not stored to the flash ROM during the Save Configuration function in ROCLINK 800 software.

The Alarm Log operates in a circular fashion with new entries overwriting the oldest entry when the buffer is full. The Alarm Log provides an audit history trail of past alarms. The Alarm Log and the Event Log are stored separately to prevent recurring alarms from overwriting configuration audit data.

Event Log

The Event Log contains changes to any parameter within the FB100 made through the protocol. This Event Log also contains other FloBoss events, such as power cycles, cold starts, and disk configuration downloads. The Event Log provides an audit history trail of past operation and changes.

The system Event Log has the capacity to maintain and store up to 240 events in a circular log. The Event Log has information fields that includes point type, parameter number, time and date stamp, point number if applicable, the operator identification, and either the previous, current parameter values, and either the Tag name of the point or a 14-byte detail string in ASCII format.

In addition to providing functionality for appending new events to the log, the Event Log allows host packages to request the index of the most recently logged event entry. Event logging is available internally to the system, to external host packages, and to the FST.

Event logs are not stored to flash ROM when you perform a Save Configuration using ROCLINK 800 software. The Event Log operates in a circular fashion with new entries overwriting the oldest entry when the buffer is full. The Event Log provides an audit trail history of past operation and changes. The Event Log and Alarm Log are stored separately to prevent recurring alarms from overwriting configuration audit data.

The FB100 has the ability to limit the AGA calculation-related events to only critical events. This can keep unnecessary events from being logged and filling the event log. The events which will not be logged are

temperature, pressure, Reynolds number, and warnings for orifice diameter, pipe diameter, and beta ratio.

1.3.3 Security

The FB100 provides for security within the unit. A maximum of 16 log-on identifiers (IDs) may be stored. In order for the unit to communicate, the log-on ID supplied to ROCLINK 800 software must match one of the IDs stored in the FB100. The Local Operator Interface port (Security on LOI) has security Enabled by default. The Comm 1 and Comm 2 can likewise be configured to have security protection, but is disabled by default.

1.3.4 Function Sequence Tables (FST)

The FB100 supports FST user programmability. Two FST programs can be developed with a maximum length of 3000 bytes each (typically 300 lines of code). The number of FST lines per execution cycle can be configured in ROCLINK 800 software. The number set on the **ROC** > **Information** screen determines both FST programs.

The FST code resides in static RAM and is backed up to flash memory when the Save Configuration function is issued through ROCLINK 800 software.

Note: For further information on FSTs, refer to the *Function Sequence Table (FST) User Manual* (D301058X012).

1.3.5 PID Control

PID Control is available when the optional I/O termination points are installed. PID (Proportional, Integral, and Derivative) functionality calculates both the Primary Control and Override Control change in output. PID Control then selects which Control is to be used, based upon whether the High Override Type Select or Low Override Type Select is chosen and adjusts the Output control as necessary. The Output of the PID functions can be implemented through an Analog Output or the two Discrete Outputs.

1.3.6 Spontaneous-Report-By-Exception (SRBX) Alarming

The SRBX functionality allows a communications port to be set up to enable the FloBoss to contact the host computer when specified alarm conditions exist. To configure SRBX alarming, each comm port must have the SRBX parameter enabled, each point must have the alarming parameter enabled, and points must have the SRBX Set on Clear parameter set.

1.3.7 Pass Through Communications

Pass Through Communications allow you to configure an FB100 unit to send Pass Through messages, when using a FB100. By using any of the FB100 communications ports, Pass Through Mode allows data to be received by one unit and then passed through to other devices connected on any other communications port. For example, the host communicates via a radio (when an external radio is used with the EIA-232 module) on the FB100's Comm 2 port. You can then connect other FB100s via EIA-485 (RS-485) on the Comm 1 port of the first FB100, and then all the FB100s can use the one radio to communicate to the host.

Notes:

- If you configure Comm 2 as a dial-up modem, you **must** configure it as a receiving port. If you configure Comm 2 as an RS-232 port, it has no such restrictions.
- The Device Group (located on the General tab of the ROC > Information screen) of the FB100 receiving the data must match the Device Group of the FB100(s) to which the data is passed. If the Device Group does not match, the data is not forwarded.

1.3.8 Protocol Automatic Switching

The FB100 has the capability to communicate with ROC or Modbus protocol. With the standard version of FloBoss firmware, Modbus Slave is standard. If you require Modbus Host functionality, contact your local sales representative.

1.3.9 User C Capability

The FB100 supports programs written in User C. This capability allows you to write and subsequently load special features into the FB100 to enhance the functionality. User C programs typically provide the ability to interface with alternate metering equipment, perform alternate calculation methods, or communicate with alternate protocols. Consult your local sales representative for User C applications.

1.4 Product Electronics

This section describes the FB100 electronics. For communication modules, refer to *Chapter 4*. Refer to *Chapter 5* for information on the I/O termination points, *Chapter 6* for the Dual-Variable Sensor (DVS), or *Chapter 7* for the Pulse Interface module.

1.4.1 Termination Board Overview

Components of the termination board (see *Figure 1-4*) support the functionality of the FloBoss 100-Series and include:

- Local operator interface (LOI) EIA-232 (RS-232) terminations

- EIA-485 (RS-485) communications (Comm 1) terminations
- RTD input terminations
- Optional I/O and terminations
- Remote charge terminations
- Optional Comm 2 terminations

1.4.2 Processor and Memory

The FB100-Series derives processing power from a 32-bit microprocessor. The 32-bit CMOS microprocessor features dual 32-bit internal data buses and a single 8-bit external data bus. The unit can address up to 4 MB of memory, including high-speed direct memory access.

The FB100 has 512 KB of static random access memory (SRAM) for storing interrupt vectors, Proportional, Integral, and Derivative alarms, events, and history data.

The FB100 also has a 2 MB flash memory chip for storing the operating system factory code, configuration parameters, and User C programs.

1.4.3 Liquid Crystal Display

An optional two-line Liquid Crystal Display (LCD) panel mounts on the Battery Charger module.

The LCD allows you to view the current and past gas volumes on site without requiring a PC. The LCD provides you a visual indication of the status of the meter run by displaying the historical performance data to help ensure the health and integrity of your installation.

The LCD panel remains on at all times when the power is applied in the valid operating range. The panel cycles its display through a configured list of up to 16 parameter values, with the first seven being pre-configured. The first three displays show values for time, date, and battery condition and cannot be configured. The next five displays show certain flow parameters and are factory configured, but you may change their configuration.

To configure the list of values for the LCD panel, refer to the LCD User List Setup procedure in the *ROCLINK 800 Configuration Software User Manual* (Part D301159X012).

1.4.4 Communications Ports

The FB100 provides two standard and one optional communication ports:

- Standard Operator interface port EIA-232 (RS-232) – LOI.
- Standard EIA-485 (RS-485) Communications – Comm 1.
- Optional EIA-232 (RS-232), or Dial-up Modem Communications – Comm 2.

Local Operator Interface (LOI) Port

The Local Operator Interface (LOI) port provides direct communications between the FB100 and the serial port of an operator interface device, such as personal computer using an EIA-232 (RS-232) link.

The interface allows you to access the FB100 (using ROCLINK 800 software) for configuration and transfer of stored data. The LOI port is capable of initiating a message in support of Spontaneous-Report-by-Exception (SRBX) alarming.

The LOI terminal on the Termination module provides wiring access to a built-in EIA-232 (RS-232) serial interface, which is capable of up to 19.2K bps operation. The operator interface port supports ROC or Modbus protocol communications. The LOI also supports the log-on security feature of the FB100, if you enable the Security on LOI through the ROCLINK 800 software.

EIA-485 (RS-485) Serial Communications on COMM1

Use Comm 1 to monitor or alter the FB100-Series from a remote site, using a host or ROCLINK 800 software. Comm 1 supports baud rates up to 19,200 bps. Comm 1 also supports the log-on security feature of the FloBoss unit if you have enabled the security on Comm 1 in ROCLINK 800 software.

Comm 1 sends and receives messages using the ROC or Modbus protocol. Comm 1 is capable of initiating a message in support of Spontaneous-Report-by-Exception (SRBX) alarming. Comm 1 permits EIA-485 (RS-485) serial communication protocols that meet EIA-485 (RS-485) specifications for differential, asynchronous transmission of data over distances of up to 1220 m (4000 ft). The EIA-485 (RS-485) drivers are designed for true multi-point applications with multiple devices on a single bus.

The default values for the EIA-485 (RS-485) communications are:

- 9600 Baud
- 8 Data Bits
- 1 Stop Bit
- No Parity
- 10 millisecond Key On Delay and
- 10 millisecond Key Off Delay

The maximum baud rate is 19,200 bps. You can disable the Comm 1 port (the default state is enabled) using the ROCLINK 800 Radio Power Control screen (select **Configure** > **Control**> **Radio Power Control** from the ROCLINK 800 software's menu).

Optional Communications Module (COMM2)

Two plug-in communication printed circuit boards and one communication module allow you to customize the FB100 installation for most communication requirements. The communication PCBs and module provide an interface for the host communications Comm 2 port. These cards permit serial communication protocols and dial-up modem communications.

The Comm 2 port is capable of initiating a message in support of Spontaneous-Report-by-Exception (SRBX) alarming. Refer to *Chapter 3* for additional information. One of the following card types can be accommodated:

- EIA-232 (RS-232) for asynchronous serial communications (baud rate up to 19,200).
- Dial-up modem for communications over a telephone network (default at 2400 baud).

1.4.5 RTD Input

The FB100 supports a direct input from a Resistance Temperature Detector (RTD) sensor to measure flowing temperature. The RTD has a measurement range of -40 to 240°C (-40 to 464°F). The terminals for the RTD wires are labeled "RTD" (see *Figure 1-4*).

During operation, the RTD is read once per second. The value from the RTD is linearized, and then it is sent to processing as Analog Input (AI) Point Number A3. The AI routine converts this value to engineering units, and checks alarming. To conserve power, the RTD power is switched on and off. During calibration, the RTD power is on constantly. When calibration completes, the RTD cycles power again.

1.4.6 Real-Time Clock

The real-time clock provides the FB100 with the time of day, month, year, and day of the week. The real-time clock automatically switches to backup power when the FB100 loses primary input power. Backup power for the real-time clock is adequate for a period in excess of five years with no power applied to the FB100.

1.4.7 Diagnostic Monitoring

The electronics board has three diagnostic inputs incorporated into the circuitry for monitoring battery voltage, logical voltage, and board temperature. Access these analog inputs using the I/O function of ROCLINK 800 software. The three values are available as the following Analog Input (AI) points:

- E1 – logical voltage
- E2 – battery voltage
- E5 – board (battery) temperature

1.4.8 Automatic Self Tests

The FB100 performs the following self-tests on a periodic basis:

- Software and hardware watchdog
- Sensor operation
- Memory validity

The FB100 operates with its internal batteries down to 5.4 volts dc. The LCD becomes active when you apply input power with the proper polarity and startup voltage (typically set greater than 8.0 volts) to the CHG+ / CHG- connector (provided the power input fusing/protection is operational). The battery and logical voltage tests ensure that the FB100 operates in the optimum mode.

The CPU controls the software watchdog circuit. The software arms the watchdog timer every second. If the watchdog timer is not armed for a period of 9 seconds, then the watchdog timer forces the FB100 to reset. If necessary, the software automatically resets. The CPU also controls the hardware watchdog circuit and monitors the power to the hardware. If the battery voltage drops below 5.4 volts, the FB100 automatically shuts down.

The FloBoss 103 monitors its orifice-metering Dual-Variable Sensor for accurate and continuous operation. The FloBoss 104 monitors its Pulse Interface Module.

1.4.9 Low Power Mode

Sleep mode places the CPU in a low power mode. Low voltage detection circuitry (preset at a low voltage limit of 5.4 V) monitors the battery voltage. During Sleep mode, sub-modules power down. The FB100 enters sleep mode after one minute of inactivity on the communication ports. Optionally, you can turn off sleep mode, which enables your FB100 to stay active all the time.

Wake-up from sleep mode occurs when the FB100 receives either a timed interrupt from the real-time clock or a signal from one of the communication ports.

1.5 Additional Technical Information

Refer to *Table 1-1* for additional and most-current technical documents (available at *www.EmersonProcess.com/Remote)*.

Table 1-1. Additional Technical Information

Name	Form Number	Part Number
FloBoss™ 103 Flow Manager	FB103	D301152X012
FloBoss™ 104 Flow Manager	FB104	D301200X012
FloBoss™ 103 and 104 Firmware	FB100:FW1	D301157X012
DVS205 Dual-Variable Sensor	DVS205	D301569X012

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Chapter 2 – Installation and Use

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This chapter focuses on the installation, mounting, and startup of the FB100.

2.1 Installation Overview

The following steps detail the general process for installing a FloBoss 103 to a pipe stand or orifice plate or for installing a FloBoss 104 to a turbine or rotary meter. Review each section in this chapter for specific instructions.

1. Install the pipe stand (if pipe stand mounting) according to the directions included with the pipe stand.
2. Remove the orifice/meter run from service.
3. Mount the FB100 assembly according to the procedures in *Section 2.3*.
4. Install the RTD and connect it to the termination board.
5. Connect the FB100 to the operator interface (ROCLINK 800 software).
6. Power the FB100. If powered externally, wire the unit to the external power source.
7. Calibrate the input(s) from the Dual-Variable Sensor or Pulse Interface module.
8. Calibrate the RTD input.
9. Connect the FB100 to any other external communication devices or networks.

Place the meter run in service and monitor with ROCLINK 800 software for proper operation.

2.2 Installation Requirements

Careful planning helps to ensure a smooth installation. Be sure to consider location, ground conditions, climate, and site accessibility, as well as the suitability of the FB100-Series application while planning an installation.

The versatility of the FB100 enables you to use it in many types of installations. For additional information concerning a specific installation, contact your local sales representative.

Note: The FB100 has been tested and been found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits provide reasonable protection against harmful interference when the equipment operates in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with this instruction manual, the FB100 may cause harmful interference to radio communications. Operation of the equipment in a residential area is likely to cause harmful interference, in which case you will be required to correct the interference at your own expense.

2.2.1 Environmental Requirements

The FB100 enclosure is classified as a NEMA 4 equivalent enclosure. This provides the level of protection required to keep the units operating under a variety of weather conditions.

The FB100 is designed to operate over a wide range of temperatures. However, in extreme climates it may be necessary to moderate the temperature in which the unit must operate.

The FB100 is designed to operate over a –40°C to +75°C (–40°F to +167°F) temperature range. The LCD temperature range is –25°C to +70°C (–13°F to +158°F). When mounting the FB100, be aware of external devices that could have an effect on the operating temperature. Operation beyond the recommended temperature range could cause errors and erratic performance. Prolonged operation under extreme conditions could also result in failure of the unit.

Check the installation for mechanical vibration. Do not expose the FB100 to levels of vibration that exceed 2g for 15 to 150 Hz and 1g for 150 to 2000 Hz.

2.2.2 Site Requirements

Careful consideration in locating the FB100 on the site can help prevent future operational problems. Consider the following when choosing a location:

- Local, state, and federal codes often place restrictions on monitoring locations and dictate site requirements. Examples of these restrictions are fall distance from a meter run, distance from pipe flanges, and hazardous area classifications.
- Locate the FB100 to minimize the length of signal and power wiring.
- When using solar-powered FB100s, orient solar panels to face **due** (**not magnetic**) south in the Northern hemisphere and **due** (**not magnetic**) north in the Southern hemisphere. Make sure nothing blocks the sunlight from 9:00 am to 4:00 pm.
- Locate antennas for radio and cellular communications with an unobstructed signal path. If possible, locate antennas at the highest point on the site and avoid aiming antennas into storage tanks, buildings, or other tall structures. Allow sufficient overhead clearance to raise the antenna.
- To minimize interference with radio or cellular communications, locate the FB100 away from electrical noise sources, such as engines, large electric motors, and utility line transformers.
- Locate the FB100 away from heavy traffic areas to reduce the risk of being damaged by vehicles. However, provide adequate vehicle access to aid in monitoring and maintenance.

2.2.3 Compliance with Hazardous Area Standards

The FB100 without optional mast kit has hazardous location approval for Class I, Division 1, Groups C to D exposures. The FB100 also has a Class I, Division 2, Groups A, B, C & D approval. The Class, Division, and Group terms are defined as:

- **Class** defines the general nature of the hazardous material in the surrounding atmosphere. Class I is for locations where flammable gases or vapors may be present in the air in quantities sufficient to produce explosive or ignitable mixtures.
- **Division** defines the probability of hazardous material being present in an ignitable concentration in the surrounding atmosphere. Division 1 locations are presumed to be hazardous. Division 2 locations are areas where gas, dust or vapors can exist under abnormal conditions.
- **Group** defines the hazardous material in the surrounding atmosphere. Groups A to D are defined as:
  - **Group A –** Atmosphere containing acetylene, gases or vapors of equivalent hazards.

- **Group B –** Atmosphere containing hydrogen, gases or vapors of equivalent hazards.
- **Group C** – Atmosphere containing ethylene, gases, or vapors of equivalent hazards.
- **Group D** – Atmosphere containing propane, gases, or vapors of equivalent hazards.

For the FB100 to be approved for hazardous locations, install it according to the National Electrical Code (NEC) Article 501, and any local code requirements, if applicable.

⚠ Caution **When installing units in a hazardous area, make sure all installation components selected are labeled for use in such areas. Installation and maintenance must be performed only when the area is known to be non-hazardous. Installation in a hazardous area could result in personal injury or property damage.**

2.3 Mounting

When choosing an installation site, be sure to check all clearances. Provide adequate clearance for wiring and service. The optional LCD should be visible and accessible for the on-site operator. When using a solar panel, allow adequate clearance and do not obstruct the view of the sun. Allow adequate clearance and an obstructed location for antennas when using cellular phones or radios.

2.3.1 General Guidelines

You can mount the FB103 enclosure assembly directly to an orifice plate using a 3- or 5-valve manifold or by using the standard Rosemount 2" pipe mounting kit with impulse tubing connecting the FloBoss 103 to the meter run.

As shown in *Figure 2-1*, the DVS is factory-mounted directly on a flat flange to the FB103 enclosure with four bolts. An adapter coupling provides the mounting interface between the enclosure and the DVS (see *Chapter 4* for additional information).

If you order the FB103 without a DVS, the factory mounts an optional blank plate to the flange. The blank plate mounts onto a pipe stand, using the standard Rosemount 2-inch pipe mounting kit and 2 user-supplied bolts (5/16 X 1 3/8) and lock washers.

You can mount the FB103 either of two ways:

- **On a pipe stand:**
  The FloBoss 103 can mount to a 2-inch pipe stand. Ensure that the pipe stand meets all weight requirements and installation conforms to local building codes.

- **On an orifice plate:**
  Directly mount to an orifice plate via a 3- or 5-valve manifold.

With either mounting method, the pressure inputs must be piped to the process connections on the DVS. For more information on process connections, refer to *Chapter 6*.

Refer to *Figures 2-1* to *2-3* for dimensions. If you intend to use the FB100 with a 5 Watt solar panel, the dimensions are 22.86 mm W by 48.01 mm H by 31.12 mm D (9.00 in. W by 18.90 in. H by 12.25 in. D).

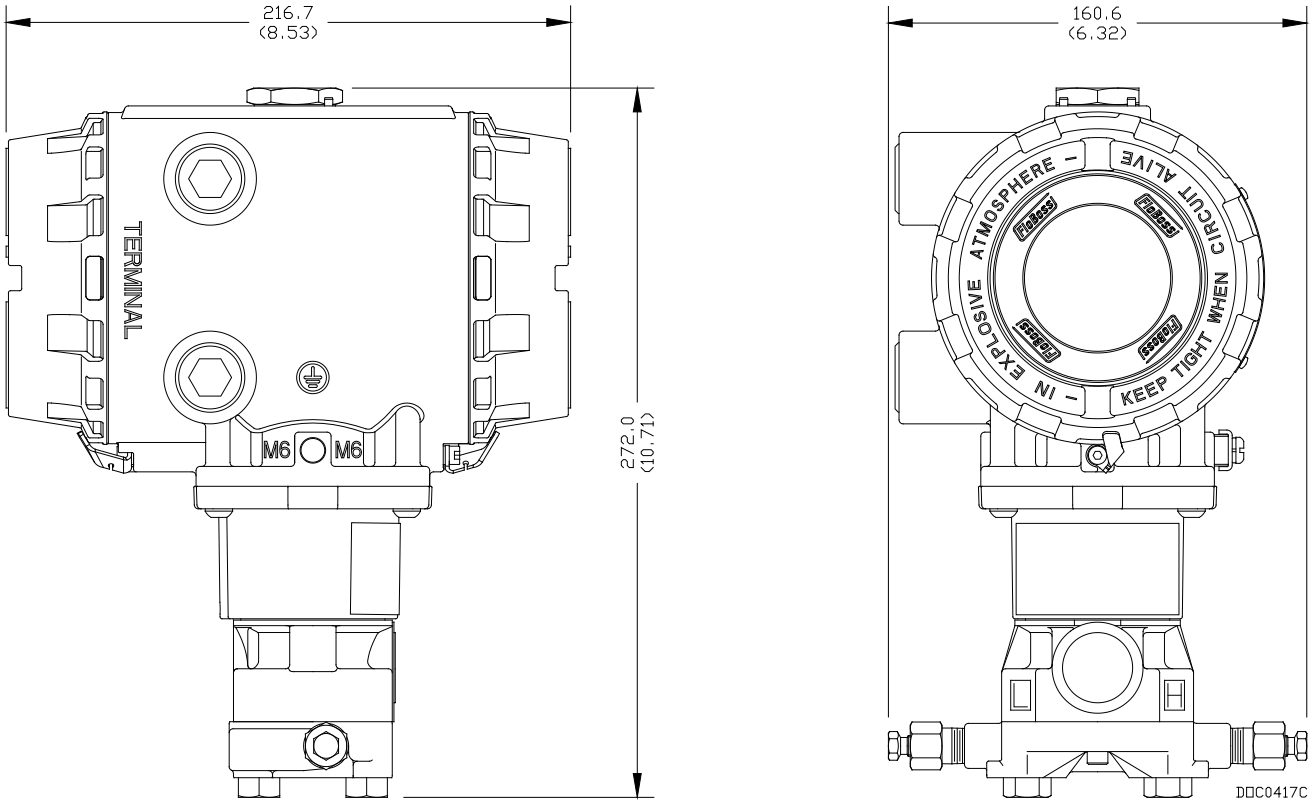


Figure 2-1. Dimensions of the FB103 (without Solar Panel)

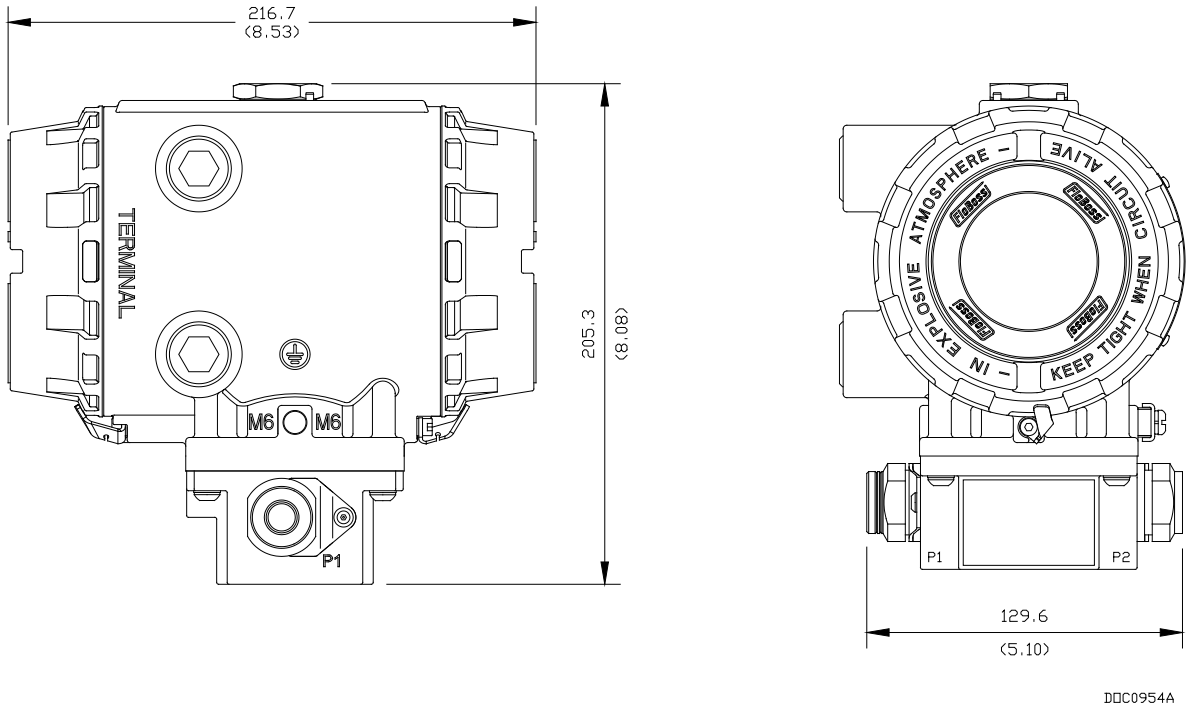


Figure 2-2. Dimensions of FB104

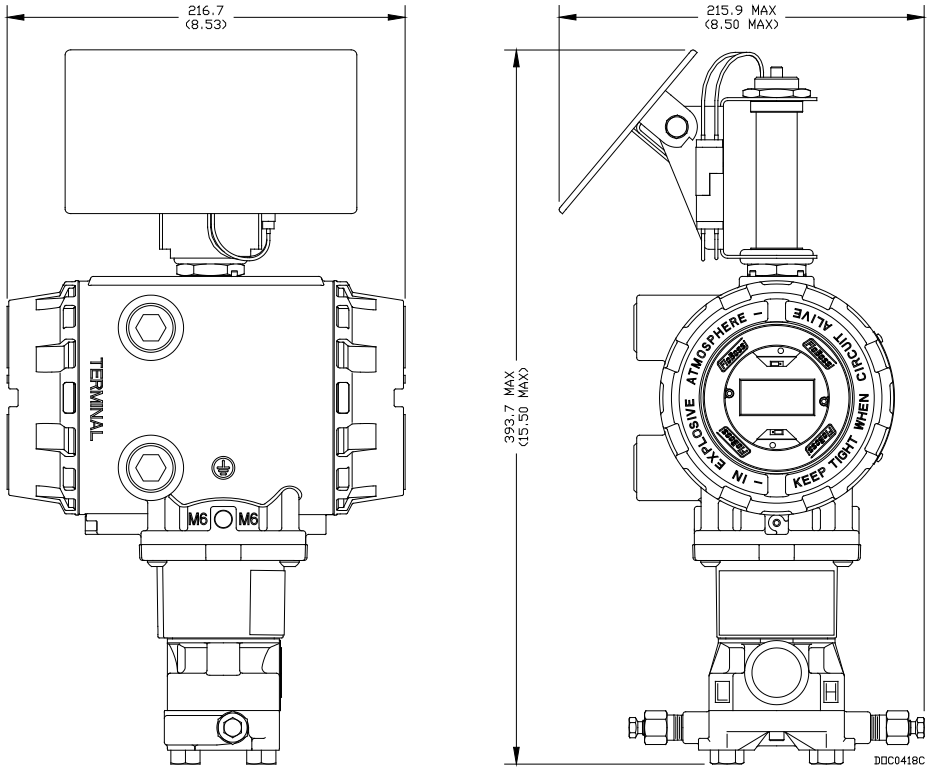


Figure 2-3. Dimensions with 2-watt Solar Panel and LCD

2.3.2 Pipe Stand Mounting (FloBoss 103/FloBoss 104)

To install the FloBoss 103/ FloBoss 104 on a 2-inch pipe stand:

1. Install the pipe stand per the directions included with the pipe stand.
2. Remove the orifice/meter run from service.
3. Install the FloBoss on the pipe stand using clamps or mounting brackets. Refer to *Figure 2-4* (for FB103) and *Figure 2-5* (for FB104).

2.3.3 Orifice Plate Mounting (FloBoss 103)

To install the FloBoss 103 on an orifice plate:

1. Remove the orifice/meter run from service.
2. Install the FloBoss 103 on the meter run using a manifold and hardware to secure the FloBoss 103 to the orifice flanges. Refer to *Figure 2-4*.

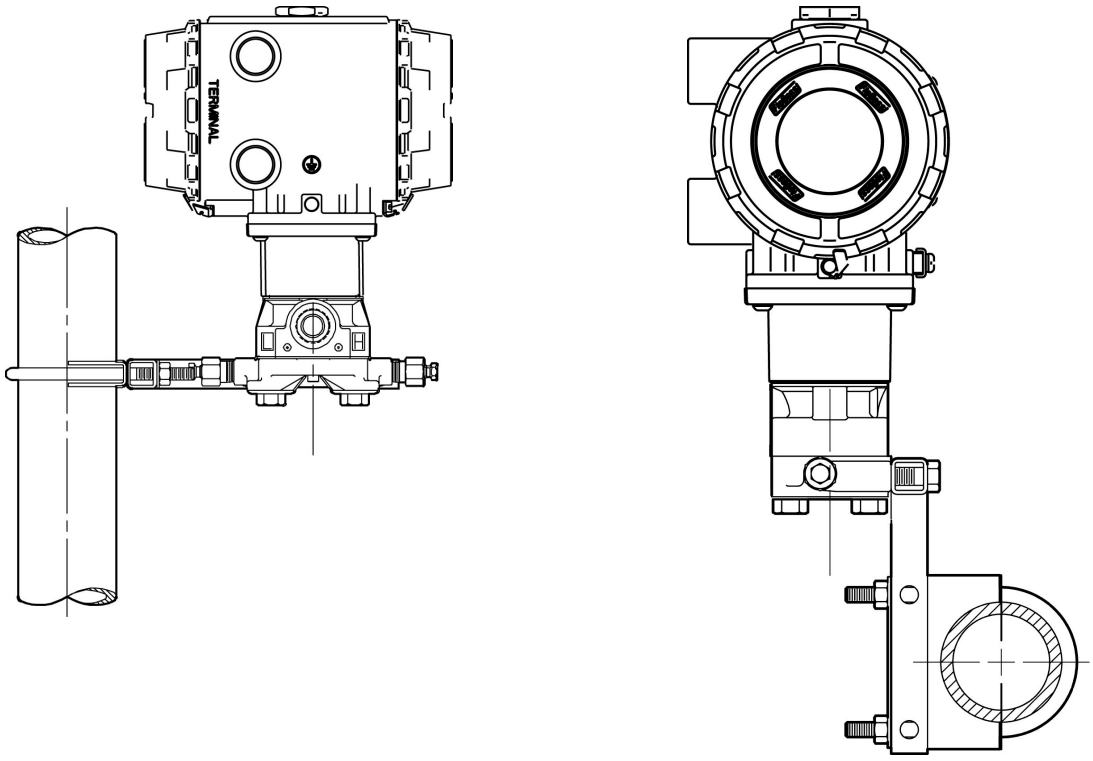


Figure 2-4. FB103 Mounting Options

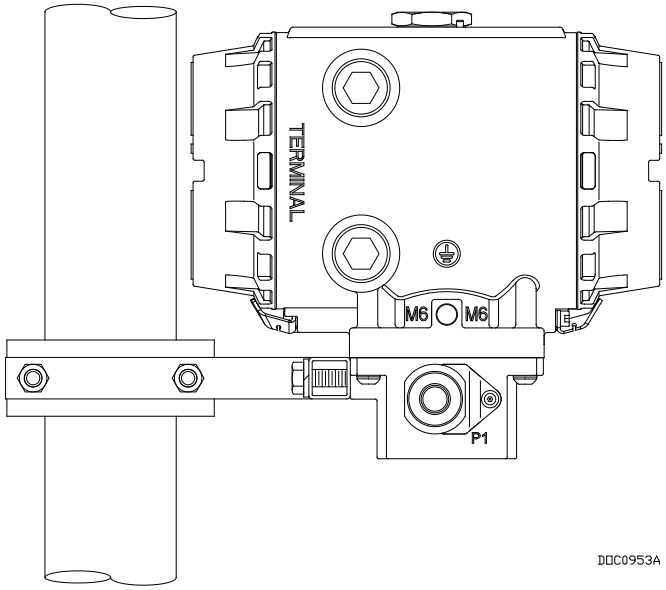


Figure 2-5. FB104 Mounting Option for ATEX unit

2.3.4 Meter Mounting (FloBoss 104)

The factory installs the Pulse Interface module to the base of the FB104. **Do not** remove the FB104 from the Pulse Interface module; you may damage cable connections between the interface and the FB100-Series backplane.

⚠ Caution **Only the factory can install or remove the Pulse Interface module. Cabling between the module and backplane can be easily damaged. The module is not a user-serviceable component.**

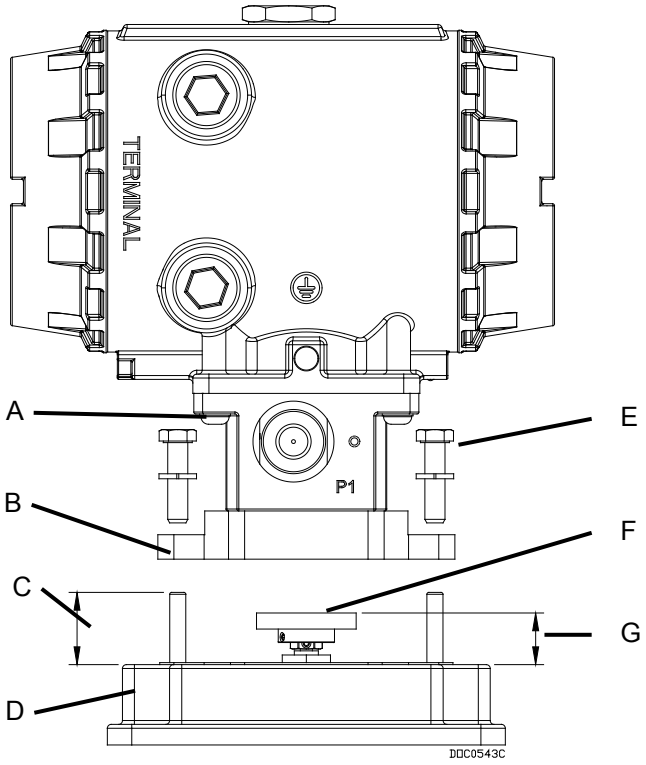
Note: The Pulse Interface module is not equipped to provide a temperature input to the FB100 for gas compensations in AGA7 calculation. Instead, this input should come directly into the FB104 from the built-in RTD input on the termination board.

If the FloBoss 104 has an optional LCD, orient the enclosure to ensure that the display is visible after installation.

To mount the Pulse Interface module to the top of the rotary meter or turbine meter:

Turbine Meter

To attach the FB104 and Pulse Interface module to a **turbine** meter, attach the meter adapter at the base of the Pulse Interface module to the meter housing with user-supplied 5/16-inch bolts (see *Figure 2-6*).



A Pulse Interface Module
B Meter Adapter
C Dowel pins extend 1.25 in min.
D Meter housing
E User-supplied 5/16-18 cap screws
F Shaft adapter
G 0.68 – 0.71 in

Figure 2-6. Mounting Pulse Interface Module to Meter Housing on non-ATEX FB104

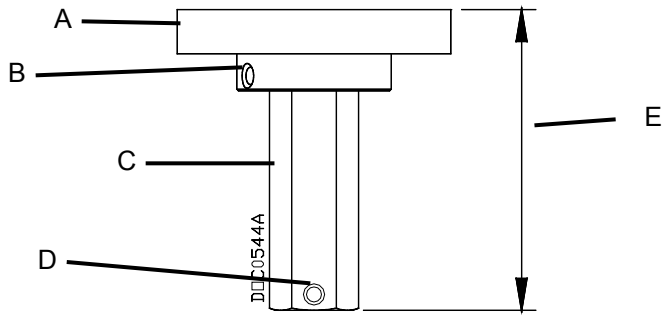
Rotary Meter

Use the following steps to attach the FB104 and Pulse Interface module to a **rotary** meter:

1. Determine which threaded hex shaft adaptor to use.
   The short adaptor has a 0.126–0.128 inch inner diameter at one end and a 0.110–0.112 inch inner diameter at the other end. The short adaptor requires a rotary meter shaft length of 0.150–0.210 inch. The long adaptor has a 0.187–0.189 inch inner diameter. The long adaptor requires rotary meter shaft length of 0.150–0.260 inch.
2. If you use the short shaft adaptor, determine which end of the adaptor fits tighter to the shaft. The end that fits tighter is the end on which you install the set-screw.
3. Loosely install the 5-40 set-screw into the appropriate hole on the shaft adaptor. The kit includes two set-screws: 0.125 inch and 0.188 inch long. The 0.125 inch long set-screw is for the long shaft adaptor. The 0.188 inch long set-screw is for the short shaft adaptor.
4. Place the adaptor with the set-screw inserted over the rotary meter shaft, and tighten the set-screw to lock the adaptor in place.

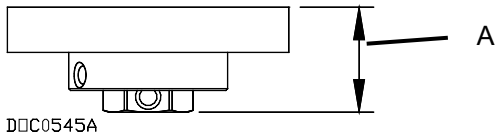
5. Thread the magnet assembly on to the shaft adaptor until the top of the magnet is between 0.68–0.71 inches above the meter housing (refer to *Figure 2-6*). The magnet set-screw should be positioned over a flat in the hex shaft adaptor. Tighten the set-screw to lock the magnet assembly in place. Refer to *Figure 2-7* and *Figure 2-8.*

Note: Align the magnet assembly so that the magnet set-screw contacts one of the shaft adaptor flats and not the shaft adaptor set-screw or any threaded areas.



A Magnet
B Magnet Set-screw
C Shaft Adaptor
D Shaft Adaptor Set-screw
E 1.90 in. Max – 1.70 in. Min

Figure 2-7. Magnet Installed on Long Shaft Adaptor



A 0.66 in. Max – 0.46 in. Min

Figure 2-8. Magnet Installed on Short Shaft Adaptor

6. Insert 0.25 inch diameter dowel pins (user-supplied) in two of the 5/16-18 UNC threaded holes on the top of the rotary meter. These pins should extend at least 1.25 inches above the meter housing so that they can be easily removed later.
7. Place the gasket provided over the dowel pins and rest it flatly on the meter housing.
8. Position the FB104 over the meter housing and carefully lower it into place using the dowel pins to guide alignment.
9. Loosely install two 5/16-18 x 7/8 long cap screws with lock washers (user-supplied) into the two threaded meter holes which do not have dowel pins. 18-8 stainless steel fasteners and washers are recommended.

10. Remove the two dowel pins. In their place, install two 5/16-18 x 7/8 long bolts and lock washers. Securely tighten all cap screws attaching the FB104 to the meter.

Once you install the Pulse Interface module to the meter, the pressure transducers are attached to the process. See *Making Process Connections* in *Chapter 7*.

2.4 Startup and Operation

Before starting the FB100, perform the following checks to ensure the unit is properly installed.

- Check the field wiring for proper installation (refer to *Chapters 3 and 4*).
- Make sure the input power has the correct polarity.
- Make sure the input power is fused at the power source. Plug the input power into the connector labeled **CHG+** / **CHG-**.

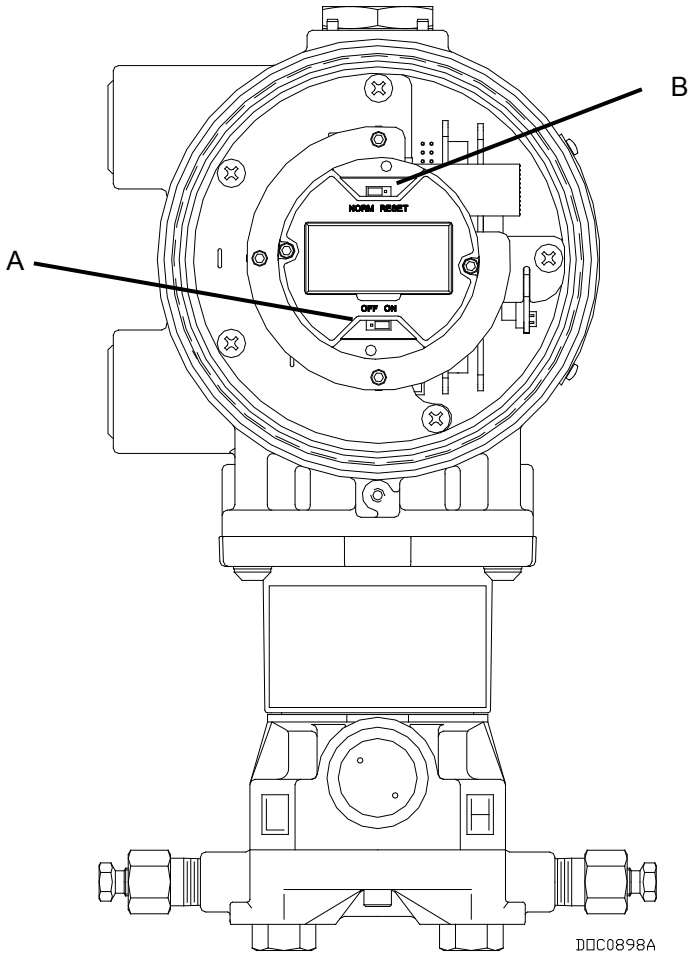
⚠ Caution **When installing equipment in a hazardous area, ensure that all components are approved for use in such areas. Check the product labels. Change components only in an area known to be non-hazardous. Performing these procedures in a hazardous area could result in personal injury or property damage.**

2.4.1 Starting the FB100

The FB100 ships with the reset jumper (located immediately below the LCD) in the OFF position to prevent unnecessary battery drainage.

To apply power to the FB100:

1. Unscrew the front end cap cover on the LCD end.
2. Place the power jumper (located on the LCD if installed or located at J1 on the Battery Charger module) in the **ON** position (see *Figure 2-9*).



A ON/OFF power jumper
B NORM RESET jumper

Figure 2-9. On/Off Power Jumper (FB103 with Optional LCD)

3. Reattach the top-end cap cover (LCD end). Screw the cover on until metal contacts metal. Do not over-tighten the cover.

After the FB100 start-up diagnostics (RAM and other internal checks) complete, the optional LCD displays the date and time to indicate that the FB100 has completed a valid reset sequence. If the LCD does not come on, refer to *Chapter 9* for possible causes and resolutions.

2.4.2 Operation

Once startup is successful, you must configure the FB100 to meet the requirements of the application. *ROCLINK 800 Software User Manual* (part D301159X012) details the procedure for configuring the FloBoss and calibrating the I/O. Once you configure and calibrate the FB100-Series. You can place it into operation.

⚠ Caution **When the enclosure end caps are unscrewed, local configuration or monitoring of the FB100-Series through its LOI port must be performed only in an area known to be non-hazardous. Performing these procedures in a hazardous area could result in personal injury or property damage.**

During operation, you can monitor the FB100 (to view or retrieve current and historical data) either locally or remotely. Accomplish local monitoring either by viewing the LCD panel or by using ROCLINK 800 software on a PC connected through the LOI port. Remote monitoring is performed through Comm 1 or Comm 2 of the FB100 using ROCLINK 800 software or a host system.

2.5 Configuration

The FB100 has a number of software settings, called parameters, which you must configure before you can calibrate the device and place it into operation. Use ROCLINK 800 configuration software for this purpose. Normally, you connect a PC running ROCLINK 800 to the LOI port of the FB100 and transfer configuration data into the FB100, although you can perform much of the configuration off-line and download it later into the unit.

The FB100 firmware provides default values for all parameters. If the default values are acceptable for your application, you can leave the values as you found them. Refer to the *ROCLINK 800 Configuration Software User Manual* (Part D301159X012).

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Chapter 3 – Power Connections

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3.1 Power Installation Requirements 3-1
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3.2.2 Installing Grounding for the FB100 3-3
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This chapter describes how to wire power for the FB100 from a DC voltage source or solar panel. It also describes batteries and grounding.

⚠ Caution **When installing units in a hazardous area, make sure all installation components selected are labeled for use in such areas. Installation and maintenance must be performed only when the area is known to be non-hazardous. Installation in a hazardous area could result in personal injury or property damage.**

3.1 Power Installation Requirements

Typical sources of primary power for FB100 installations are DC voltage sources and solar power. Take care to route power away from hazardous areas, sensitive monitoring devices, and radio equipment. Local and company codes generally provide guidelines for power installations. Adhere rigorously to all local and National Electrical Code (NEC) requirements for power installations.

The FB100 accepts input voltages from 8.0 volts to 28 volts at the charge (CHG+ / CHG-) terminals on the termination board.

Note: The maximum power usage for DC voltage sources is 130 mW for the FloBoss 103 and 300 mW for the FloBoss 104, excluding battery charging.

⚠ **Caution**	**Do not allow the batteries to fully discharge. Either keep providing input power or turn the device off. If the batteries fully discharge, the battery charger board may enter thermal limiting, which prevents the batteries from overheating but restricts input power.**

⚠ **Warning**	**Connecting the FB103 or FB104 to a continuous power source without removing the battery charger module may result in battery overcharging and failure. See *Section 3.5.1, Overcharging Potential*.**

3.2 Grounding Installation Requirements

The National Electrical Code (NEC) governs grounding wiring requirements for DC voltage sources equipment. When the equipment uses DC voltage sources, the grounding system must terminate at the service disconnect. All equipment grounding conductors must provide an uninterrupted electrical path to the service disconnect.

- The National Electrical Code Article 250-83 (1993), paragraph c, defines the material and installation requirements for grounding electrodes.
- The National Electrical Code Article 250-91 (1993), paragraph a, defines the material requirements for grounding electrode conductors.
- The National Electrical Code Article 250-92 (1993), paragraph a, provides installation requirements for grounding electrode conductors.
- The National Electrical Code Article 250-95 (1993) defines the size requirements for equipment grounding conductors.

3.2.1 Grounding Guidelines

Properly grounding the FB100 helps to reduce the effects of electrical noise on the unit's operation and protects against lightning. The FB100 provides lightning protection for built-in field wiring inputs and outputs. Install a surge protection device at the service disconnect on DC voltage source systems to protect against lightning and power surges for the installed equipment. You may also consider a telephone surge protector for the optional dial-up modem communications card.

All earth grounds must have an earth-to-ground rod or grid impedance of 25 ohms or less as measured with a ground system tester. The grounding conductor should have a resistance of 1 ohm or less between the FB100 enclosure ground and the earth ground rod or grid.

The recommended cable for I/O signal wiring is an insulated, shielded, twisted-pair. The twisted pair and the shielding minimize signal errors caused by EMI (electromagnetic interference), RFI (radio frequency interference), and transients.

3.2.2 Installing Grounding for the FB100

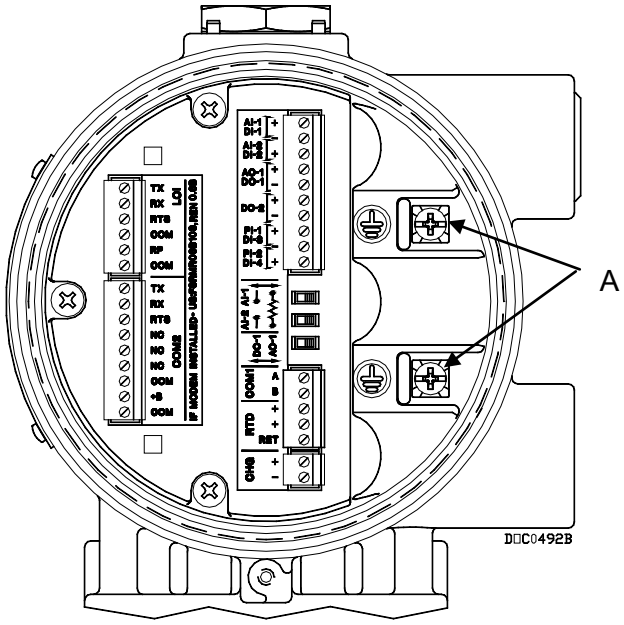
The FB100 unit has two grounding screws inside the enclosure and one grounding screw outside the enclosure. For the grounding screw locations, refer to *Figure 3-1*.

The grounding installation method for the FloBoss 100-Series depends on whether the pipeline has cathodic protection. On pipelines with cathodic protection, the FB100 must be electrically isolated from the pipeline.

Electrical isolation can be accomplished by using insulating flanges upstream and downstream on the meter run. In this case, the FloBoss 100-Series could be flange mounted or saddle-clamp mounted directly on the meter run and grounded with a ground rod or grid system.

On pipelines without cathodic protection, the pipeline itself may provide an adequate earth ground and the FB100 could mount directly on the meter run using an orifice plate. Test with a ground system tester to make sure the pipeline to earth impedance is less than 2 ohms. If the pipeline provides an adequate ground, you may not need to install a separate ground rod or grid system. All grounding should terminate at a single point.

If the pipeline to earth impedance is greater than 2 ohms, the FloBoss installation should be electrically isolated and a ground rod or grid grounding system installed.



A Internal grounding screws

Figure 3-1. Location of Grounding Screws

3.3 Determining Power Requirements

To adequately meet the needs of the FloBoss system, it is important to determine the total power consumption and size of solar panel requirements accordingly. For total FB100 power consumption, be sure to add the power consumption (in mW) of any other devices used with the FB100 in the same power system. **The maximum power for DC voltage sources is 130 mW for the FloBoss 103 and 300 mW for the FloBoss 104, not including the battery charging.**

Convert the total value (in mW) to Watts by dividing it by 1000.

mW / 1000 = Watts

For selecting an adequate power supply, use a safety factor (SF) of 1.25 to account for losses and other variables not factored into the power consumption calculations. To incorporate the safety factor, multiply the total power consumption (P) by 1.25.

$P_{SF} = P \times 1.25 =$ _____ Watts

To convert P_{SF} to current consumption in amps (I_{SF}), divide P_{SF} by the system voltage (V) of 12 volts.

$I_{SF} = P_{SF} / 12V =$ _____ Amps

3.4 Solar Powered Installations

Solar power allows you to install the FB100 in locations where a DC voltage source is not available. Be sure to size solar panels properly for the application and geographic location to ensure continuous and reliable operation.

A 2-Watt or 5-Watt solar panel can be ordered and installed to provide charging power for the backup batteries. An external solar panel typically mounts to the same 2-inch pipe that supports the FB100. The panel wiring terminates at the charge (CHG+ / CHG-) power terminals on the termination board.

The panel must face **due** (**not magnetic**) south in the Northern Hemisphere and **due** (**not magnetic**) north in the Southern Hemisphere. The panel must also be tilted at an angle from horizontal dependent on latitude to maximize the energy output. The angles for different latitudes are normally included in the solar panel documentation. At most latitudes, the performance can be improved by less of an angle during the summer and more of an angle during the winter.

As a site may have additional power requirements for repeaters, and other monitoring devices, power supply and converter accessories may be used to minimize the number of separate power sources required for an installation.

Solar arrays generate electrical power for the FB100 from solar radiation. The size of solar panels required for a particular installation depends on several factors, including the power consumption of all devices connected to the solar array and the geographic location of the installation.

The optional solar panel is adequate for support of API Chapter 21.1 compliant measurement and the retrieval of the historical logs once a day using the internal communication methods.

3.4.1 Sizing the Solar Panel

To determine solar panel output requirements, first determine the solar insolation for your geographic area. The map in *Figure 3-2* shows solar insolation (in hours) for the United States during winter months. Call your local sales representative for a map detailing your specific geographic area.

Insolation (from map) = _____ hours

Next, calculate the amount of current required from the solar array per day using the following equation. I_{SF} is the system current requirement. Refer to *Section 3.3*.

I_{array} = [I_{SF} (amps) × 24 (hrs)]/Insolation (hrs) = _____ amps

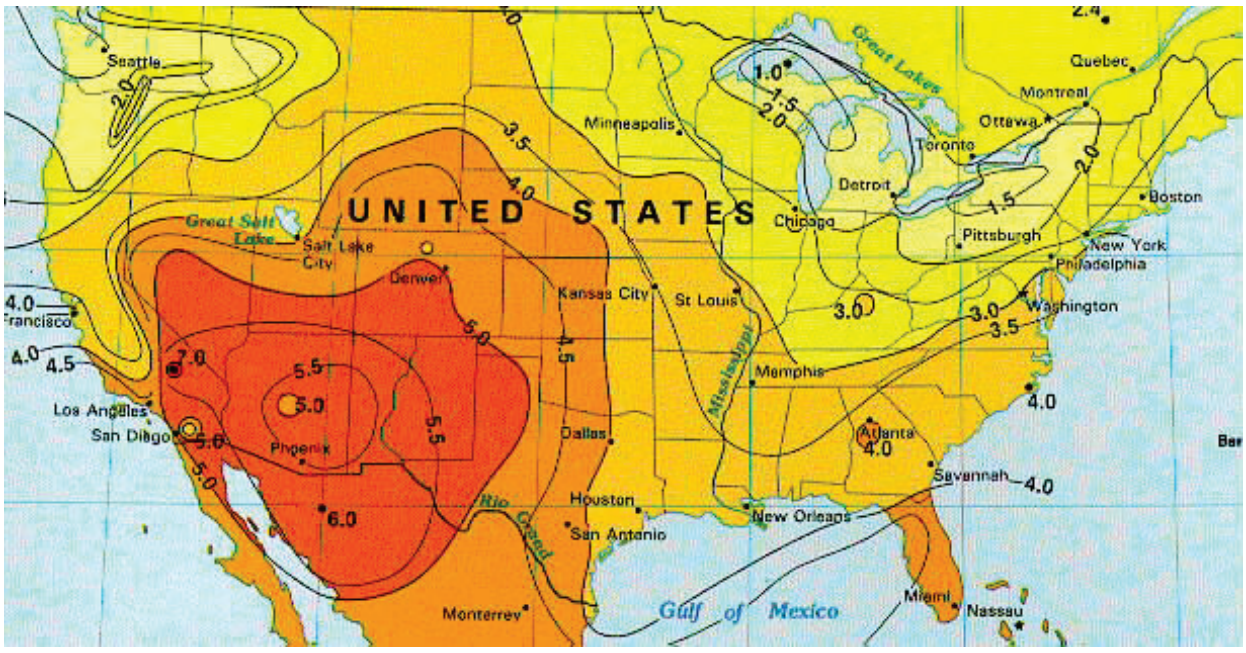


Figure 3-2. Solar Insolation in Hours for the United States

Note: Refer to *http://www.solar4power.com/solar-power-global-maps.html* for global solar insolation maps.

Notes:

- The "I panel" value varies depending on the type of solar panel installed. Refer to the vendor's specifications for the solar panel being used.
- The FB100 can accept a maximum of about 1 Amp, limited by its charging circuit. Therefore, it is not practical to install a solar array that supplies significantly more than 1 Amp to the FB100. The maximum input is 28 volts.

⚠ Caution **Do not allow the batteries to fully discharge. Either keep providing input power or turn the device off. If the batteries fully discharge, the battery charger board may enter thermal limiting, which prevents the batteries from overheating but restricts input power.**

3.5 Batteries

Batteries provide power for the FB100 when the solar panels are not generating sufficient output. The batteries are three D-size lead-acid batteries providing 2.5 Amp-hours of current at 6.2 volts.

The batteries are connected in series by the Battery Charger module to achieve the required capacity. The amount of battery capacity determines the number of days of reserve (autonomy) desired.

When you configure the FB100 as an API compliant Electric Flow Management (EFM) and require an internal communications card, a solar panel, and the internal batteries, the FB100 should be able to communicate the API audit trail information once a day to a remote host using no additional battery source, no additional solar panel, and maintain a 13 day autonomy in the event that the solar panel is lost.

Note: Remote Automation Solutions matches the batteries and charger board to provide proper charging circuitry. Use only batteries supplied by Remote Automation Solutions in an FB100.

3.5.1 Overcharging Potential

If you connect the FB103 or FB104 in one of the following ways, it is possible to overcharge the internal power batteries:

- External constant power (battery, battery farm, or a constant DC source) wired to the CHG terminals with the internal batteries installed (FB103C1/FB104C1)
- External solar power panel generating greater than 5 Watts (FB103C1/FB104C1)
- External power source (solar or DC) wired into the TB1 terminal located on the battery terminal board (FB103C1/FB104C1)

In these circumstances, **remove** the battery charger module (part W38231X0032) and use the FB103 or FB104 **without** internal power batteries. Refer to *Section 3.5.3, Replacing the Batteries*, for instructions on removing the battery charger module or contact Remote Automation Solutions LifeCycle Services for assistance in removing the battery charger module.

3.5.2 Determining Battery Requirements

To determine the system capacity requirements, multiply the system current load (I_{SF}) on the batteries by the amount of reserve time required. Compute "I_{SF}" as described in *Section 3.3, Determining Power Requirements.*. The equation is as follows:

System Requirement = I_{SF} amps × Reserve hrs = _____ amp-hrs

3.5.3 Replacing the Batteries

The battery pack contains three D-size lead-acid batteries providing 2.5 Amp-hours of current at 6.2 volts nominal.

⚠ Caution

When installing equipment in a hazardous area, ensure that all components are approved for use in such areas. Check the product labels. Change components only in an area known to be non-hazardous. Performing these procedures in a hazardous area could result in personal injury or property damage.

To avoid circuit damage when working inside the unit, use appropriate electrostatic discharge precautions, such as wearing a grounded wrist strap.

To replace the battery pack:

1. Unscrew the front end (LCD end) cap cover.
2. Place the power jumper (located at J1 on the Battery Charger module) in the OFF position.
3. Remove the ribbon cable from the Battery Charger module to the Backplane Board.
4. Remove the four screws from the Battery Charger module.
5. Remove the Battery Charger module.
6. Replace the Battery Charger module.
7. Replace the four screws from the Battery Charger module.
8. Replace the ribbon cable from the Backplane Board to the Battery Charger Board.
9. Place the power jumper (located at J1 on the Battery Charger module) in the ON position.
10. Replace the front end cap cover. Screw the cover on until metal contacts metal. Do not over-tighten the cover.

3.6 Wiring Connections

The following paragraphs describe how to connect the FB100 to power, I/O devices, and communications devices. Use the recommendations and procedures described in the following paragraphs to avoid damage to equipment.

Note: Check the input power polarity before turning on the power.

The external connections or field terminals are all located on the termination board. The terminal block accepts wires up to 16 AWG in size.

⚠ Caution

Always turn off the power to the FB100 before you attempt any type of wiring. Wiring powered equipment could result in personal injury or property damage.

To avoid circuit damage when working inside the unit, use appropriate electrostatic discharge precautions, such as wearing a grounded wrist strap.

3.6.1 Wiring Connections

The connectors on the FB100 Termination module use compression terminals. The input power termination (CHG+ / CHG-) uses a removable connector and accommodates wiring up to 16 AWG in size. In all cases, make connections by baring the end (¼ inch maximum) of the wire, inserting the bared end into the clamp beneath the termination screw, and then tightening the screw to 0.25 N-m (2.2 lb-in.).

Note: Do not over torque the connector screws.

The inserted wires should have a minimum of bare wire exposed to prevent short circuits. Allow some slack when making connections to prevent strain.

3.6.2 Connecting Enclosure Ground Wiring

The FB100 and related components use the National Electrical Code (NEC) that governs the ground wiring requirements.

Two ground screws are located inside the back of the enclosure. **It is recommended that a minimum of 14 AWG wire be used for the ground wiring.**

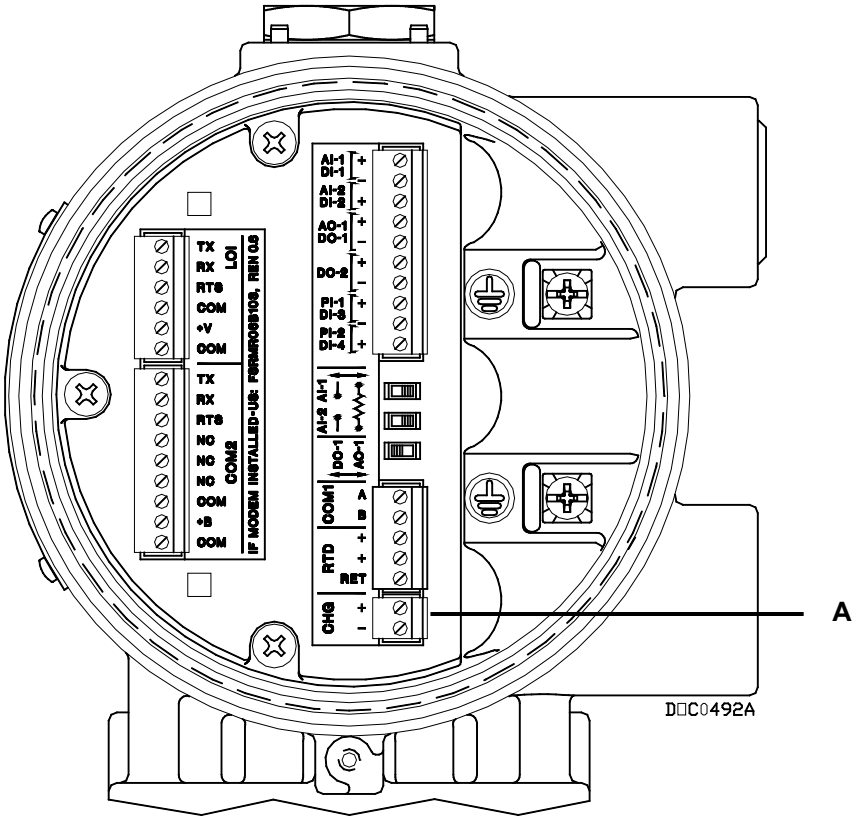
3.6.3 Connecting Main Power Wiring

The FloBoss 100-Series accepts input voltages from 8.0 volts to 28 volts at the charge terminals (CHG+ / CHG-) with no external current limiting (internal current limit is 200 mA). **The maximum power for DC voltage sources is 130 mWatts for the FloBoss 103 and 300 mWatts for the FloBoss 104, not including battery charging.**

The terminals are labeled CHG+ for positive power connection (Battery 8.0 to 28 volts power) and CHG- for negative power connection (Battery Common) on a label on the termination board. Refer to *Figure 3-3*.

Notes:

- The terminal block for power (CHG) is located at the bottom of the right-hand column. In earlier versions of the FB103, the terminal block may have other locations.
- Check the label for the pin location of the CHG+ and CHG- terminals carefully. If the positive and negative connections are reversed, the internal batteries will not charge.



A CHG terminator

Figure 3-3. Termination Board

It is important to use good wiring practices when sizing, routing, and connecting power wiring. Ensure that all wiring conforms to state, local, and NEC codes. The CHG+ / CHG- terminal can accommodate up to 16 AWG wire**.**

⚠ Warning **Use only solar panels approved for use with the FB100 in Class 1, Division 2 locations.**

These connections provide the input voltage and power for the battery charging circuitry. The maximum voltage that can be applied to the CHG+ / CHG- terminals is 28 volts dc.

3.7 Backing Up Configuration and Log Data

This procedure preserves the current flow computer configuration and log data held in RAM. Perform this backup procedure **before** you remove power from the FB100 for repairs, troubleshooting, removing or adding components, or upgrades.

⚠ Caution **When installing equipment in a hazardous area, ensure that all components are approved for use in such areas. Check the product labels. Change components only in an area known to be non-hazardous. Performing these procedures in a hazardous area could result in personal injury or property damage.**

To avoid circuit damage when working inside the unit, use appropriate electrostatic discharge precautions such as wearing a grounded wrist strap.

1. Launch ROCLINK 800 software and connect to the FB100.
2. Ensure that the configuration is saved in flash memory by performing a **Save to Flash Memory** (**ROC** > **Flags**). This saves all configuration settings, including the current states of the ROC Flags and calibration values.
3. Select **ROC** > **Collect Data** and select the All checkbox. Click **OK**. This action saves event logs, alarm logs, report data, and history. You can specify your own file name and path if desired.
4. Select **File** > **Save**. The Save As dialog box appears.
5. Type the desired **File name** for the backup file, or use the default.
6. Click **Save**. The file is saved in the default directory C:/Program Files/ROCLINK 800/Data, unless you changed the directory.

Chapter 4 – Input/Output

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This chapter describes the optional Input/Output (I/O) termination points available on the termination board. The I/O termination points provide additional inputs and outputs for implementing expanded monitoring and control applications. This section also describes the RTD Input on the termination board.

4.1 I/O Description

The I/O uses the microprocessor to monitor, control, and acquire data from external devices connected to the I/O channels. The I/O channels have a removable plug-in terminal block *(Figure 4-1)* for field wiring. Available I/O includes:

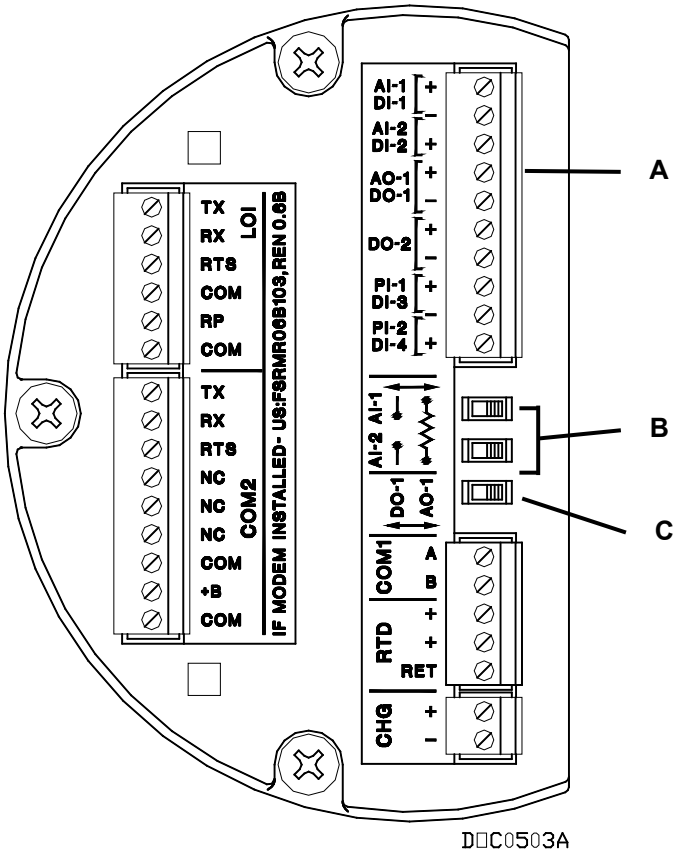
- Analog Input – AI.
- Analog Output – AO.
- Discrete Input – DI.
- Discrete Output – DO.
- Pulse Input – PI.

You can select five of the six points of I/O. The Analog Output may be switched to a Discrete Output (switch on termination board). The Analog Inputs and Pulse Inputs may be selected as Discrete Inputs on the I/O Setup screen in ROCLINK 800 Configuration software.

4.1.1 Selecting the Type of I/O

To select the type of output for the **Analog Output/Discrete Output** #1 channel, flip the AO/DO switch on the termination board to the desired position. Refer to *Figure 4-1* for the switch location. Then select the desired output type on the Configure > I/O > Setup screen in ROCLINK 800 configuration software. Analog Output is the default position for this channel.

To select the type of input for the **Analog Input/Discrete Input** and **Pulse Input/Discrete Input** channels, use the Configure > I/O > Setup screen in ROCLINK 800 configuration software. The defaults are Analog Input and Pulse Input.



A Optional I/O terminal block
B 250-ohm resistor switches
C AO/DO switch

Figure 4-1. Termination Board with Optional I/O

4.2 I/O Wiring Requirements

I/O wiring requirements are site and application dependent. Local, state, or NEC requirements determine the I/O wiring installation methods. Direct burial cable, conduit and cable, or overhead cables are options for I/O wiring installations.

4.3 Analog Input

The diagnostic Analog Inputs (logic voltage, battery voltage, and board/battery temperature) are not designed to be configured or wired.

The pressure and temperature inputs are configured as the first three Analog Input points in ROCLINK 800 Configuration software: Differential pressure or Pressure, Static pressure or Auxiliary pressure, and RTD temperature. The RTD input is the only one of these to be wired; refer to *Section 4.8.1*.

The Analog Input (AI) on the termination board monitors current loop and voltage input devices. The A/D signal input range is 0–5 volts, or 0–20 mA, with 12-bit resolution. You configure the AI using ROCLINK 800 software.

Note: External power is required to power the devices sending the 0–20 mA signals to the FB100.

4.3.1 Wiring the Analog Input

Figure 4-2 shows the terminals for connecting the Analog Input wiring. The "+" terminal is the positive signal input and the "–" terminal is the signal common. These terminals accept a voltage signal in the 0–5 volt range. Because the "–" terminal is internally connected to common, the Analog Input channels function as single-ended inputs only.

Use current inputs of 0–20 mA when the switch for a 250-ohm resistor is enabled. This switch is located below the terminations (see *Figure 4-1*).

Note: When connecting the analog input channel to a voltage device, be sure to **disable** the 250-ohm resistor switch on the termination board.

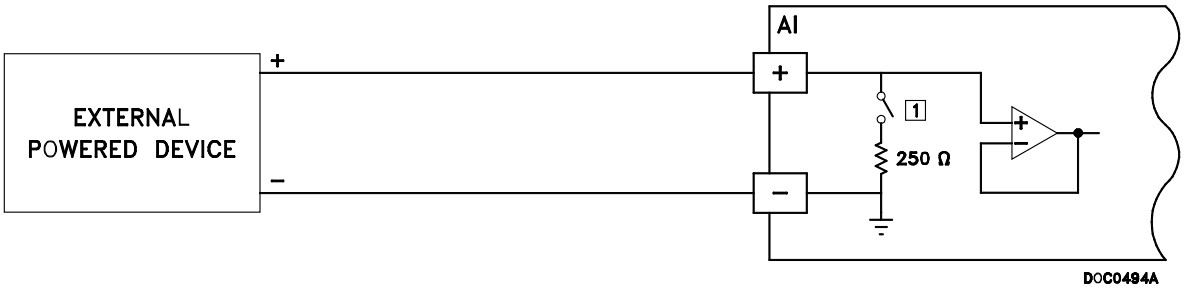


Figure 4-2. Analog Input Wiring

4.4 Analog Output

The Analog Output (AO) on the 6-point I/O termination board provides a 4–20 mA current source. The analog outputs use a 12-bit D/A converter with A/D values of 0 and 4095.

Note: The switch for the selectable Analog Output/Discrete Output should be in the AO position, when configured for use as an Analog Output.

The Analog Output (AO) on the older 4-point I/O termination board provides either a 1–5 volt signal or a 4–20 mA current control. The analog outputs use an 8-bit D/A converter with A/D values of 0 and 250. The AO is located at Point Number B2.

4.4.1 Wiring the Analog Output (6-point I/O Board)

Figure 4-3 shows wiring for the Analog Output, where:

AO+ Positive
AO- Common

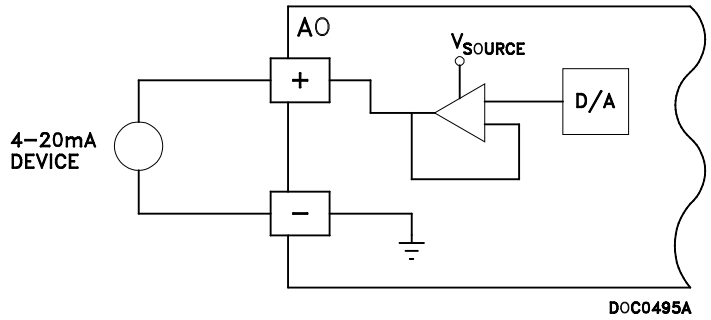


Figure 4-3. Analog Output Wiring for 6-point I/O Board

4.4.2 Wiring the Analog Output (4-point I/O Board)

Figure 4-4 shows the analog output wired as a current source, where

AO+ Positive
IC Current control
AO- Common

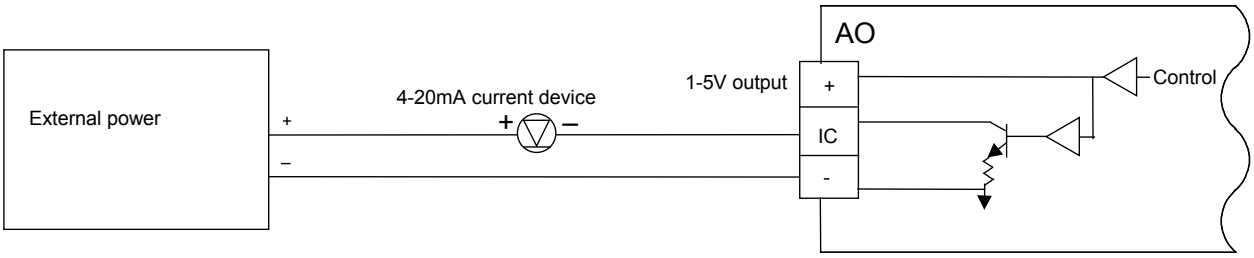


Figure 4-4. 4–20 mA Analog Output Current Control

Figure 4-5 shows the analog output wired as a voltage source:

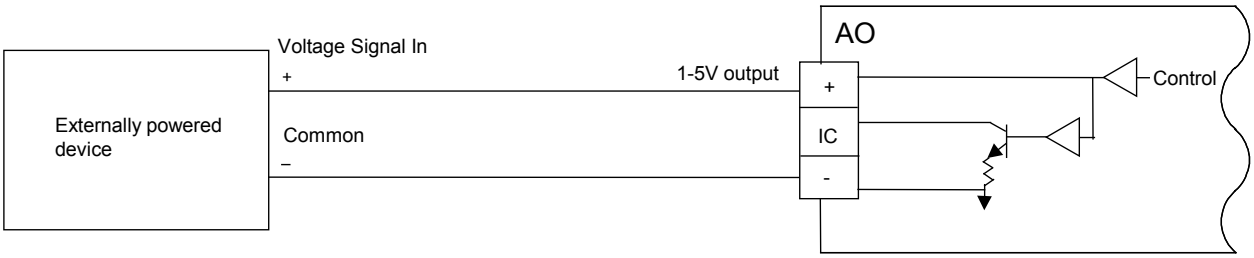


Figure 4-5. 1–5 Volts Analog Output Voltage Control

4.5 Discrete Input

The Discrete Input (DI) monitors the status of relays, solid-state switches, or open collector devices. DI functions support discrete latched inputs and discrete status inputs.

When a field device, such as a relay contact or open collector, is connected across "+" and "–," the closing of the contacts completes the circuit which causes a flow of current between Vs and ground at terminal "–." This current flow activates and is sensed in the DI circuitry that, in turn, signals the FB100 electronics indicating that the relay contacts have closed. When the contacts open, current flow is interrupted and the DI circuit signals to the FB100 electronics that the relay contacts have opened.

You configure the selectable Pulse Inputs/Discrete Inputs as pulse inputs using ROCLINK 800 software. Refer to *Section 4.1.1*.

Note: The selectable analog inputs/discrete input channels should have the 250-ohm resistor **disabled** when configured for use as discrete inputs.

4.5.1 Wiring the Discrete Input

Figure 4-6 shows the terminals for connecting the DI wiring. The "+" terminal is the positive signal input and the "–" terminal is the signal common. The Discrete Input operates by providing a closed contact across terminals "+" and "-". Refer to *Figure 4-6*.

⚠ Caution **The Discrete Input is designed to operate only with non-powered discrete devices, such as "dry" relay contacts, open collector devices, or isolated solid state switches. Use of the DI channel with powered devices may cause improper operation or damage.**

Figure 4-6. Discrete Input Wiring

4.6 Discrete Output

The Discrete Output (DO) provides a solid-state switch to control relays and to power small electrical loads. The DO circuitry is optically coupled to help isolate the processor board from the input signal.

DO functions include:

- Sustained discrete outputs.
- Momentary discrete outputs.
- Slow pulse-train outputs.

The Discrete Output channel is a normally-open, FET switch. The Discrete Output is a solid-state switch enabled by individual signals from the processor I/O lines and capable of handling 50 V dc at 0.2 A maximum.

The Discrete Output on the I/O termination board can be used in:

- Toggle mode.
- Latched mode.
- Timed discrete output (TDO) mode.

Note: The switch for the selectable Analog Output/Discrete Output (DO-1) should be in the DO position, when configured for use as a Discrete Output.

4.6.1 Wiring the Discrete Output

Figure 4-7 shows the DO wiring. The "+" terminal is the normally open contact and the "–" terminal is the common.

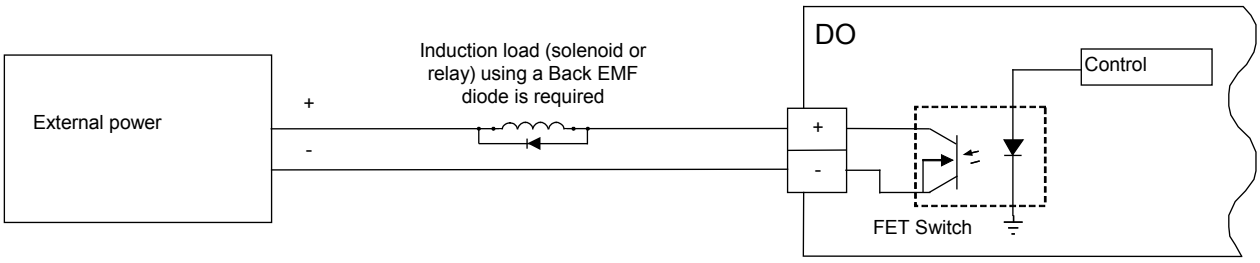


Figure 4-7. Solid State Relays – Discrete Outputs

4.7 Pulse Input

The Pulse Input (PI) counts pulses from pulse-generating devices. The FB100 Pulse Input circuits are physically the same as the Discrete Inputs. The Pulse Input, after the isolation, routes to a pulse accumulator, where the pulses are counted and accumulated.

You configure the selectable Pulse Inputs/Discrete Inputs as pulse inputs using ROCLINK 800 software. Refer to *Section 4.1.1*.

4.7.1 Wiring the Pulse Input

Figure 4-8 shows DI wiring. The "+" terminal is a positive source voltage and the "–" terminal is the signal return. To use the channel as a pulse input (shown in *Figure 4-8*), connect the "+" and "–" field wires to terminals "PI-1+" or "PI-2+" and "–".

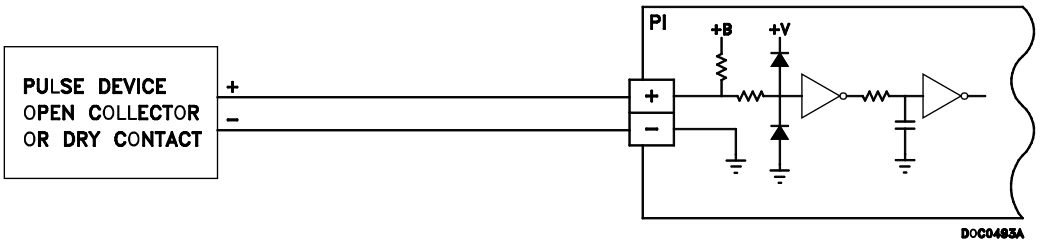


Figure 4-8. Pulse Input Wiring

4.8 RTD Input

The temperature is input through the Resistance Temperature Detector (RTD) probe and circuitry. The RTD temperature probe mounts directly to the piping using a thermowell, outside the FloBoss enclosure. The RTD probe is then wired to the FloBoss RTD connections. The RTD wires should be protected either by a metal sheath or by conduit connected to a liquid-tight field conduit wiring fitting on the enclosure. The RTD signal is monitored by a 16-bit A/D converter and then read by the microprocessor.

4.8.1 Wiring the RTD Input

The RTD wires connect to the three screw terminals designated "RTD" on the Termination board.

The FB100 provides terminations for a three-wire or two-wire 100-ohm platinum RTD with a DIN 43760 curve. The RTD has an alpha equal to 0.00385 Ω/ Ω.

Wiring between the RTD probe and the FB100 should be shielded wire, with the shield grounded only at one end to prevent ground loops. Ground loops can cause RTD input signal errors.

Table 4-1 shows the connections at the RTD terminals for the various RTD probes

Table 4-1. RTD Signal Routing

Terminal	Designation	3-Wire RTD	2-Wire RTD
+	Signal positive input	RTD +	RTD +
+	Signal positive input	RTD +	Jumper to RTD +
RET	Return reference	RTD RET	RTD RET

Chapter 5 – Communications

In This Chapter

5.1 Communications Overview 5-1
5.2 EIA-485 (RS-485) Communications Wiring 5-2
5.3 Local Operator Interface Port Wiring 5-2
5.4 Serial Communications Card 5-3
5.5 Dial-up Modem Communications Card 5-4

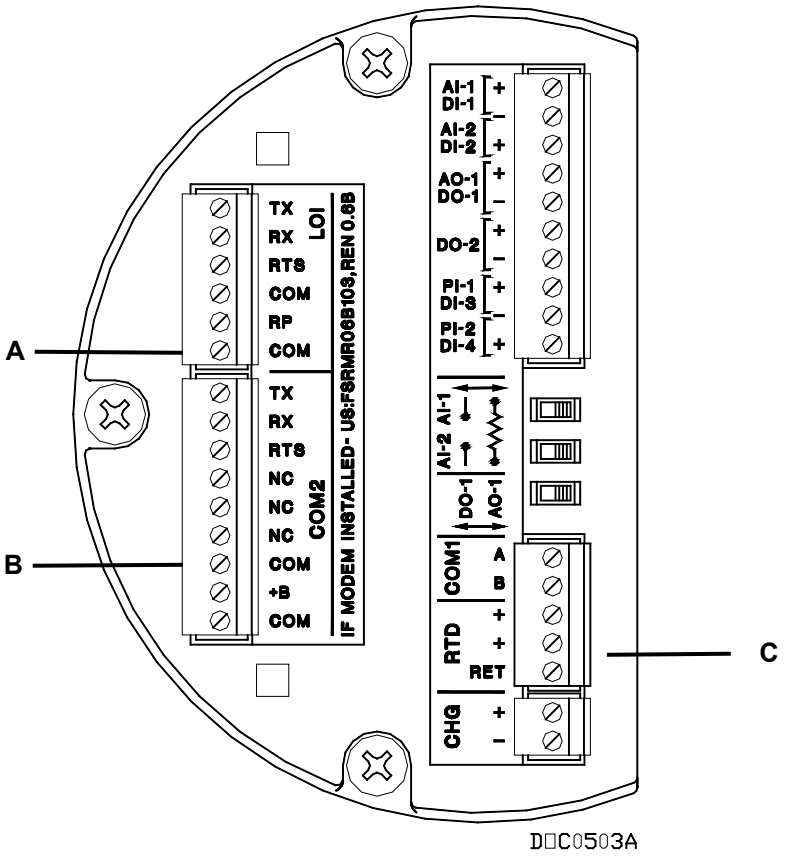
This chapter describes the communications ports and cards available for FB100.

5.1 Communications Overview

The FB100 communicates to external devices through its local operator interface port (LOI), the Comm 1 EIA-485 (RS-485) port, or the optional Comm 2 EIA-232 (RS-232)/ EIA-485 (RS-485) /dial-up modem/ port (see *Figure 5-1*).

The communications terminals and communication cards provide communications between the FB100 and a host system or external devices. The communications cards install directly onto the backplane board and activate the host port (Comm 2) when installed. You may use the EIA-232 (RS-232) Serial Communications Card, EIA-485 (RS-485) Serial Communications Card, the Dial-up Modem Communications Card.

Note: To enable or disable the Comm 2 port, select **Configure** > **Radio Power Control** and select the Enabled or Disabled option under Radio Power Control.



A LOI port
B Comm 2 port
C Comm 1 port

Figure 5-1. Communication Port Locations on Termination Board

5.2 EIA-485 (RS-485) Communications Wiring

The EIA-485 communications accommodates RS-485 and EIA-485 signals on the Comm 1 port located on the termination board.

Wiring should be twisted-pair cable. The terminals and their functions are Pin 1 is Terminal B and Pin 2 is Terminal A. Refer to *Figure 5-1*. Connect A on the FB100 to A or +, and connect B on the FB100 to B or -. Should you encounter difficulties establishing a connection, try reversing the connections. Note that for RS-485 installations the TX terminal (as labeled) is the A connection and the RX terminal is the B connection.

5.3 Local Operator Interface Port Wiring

The Local Operator Interface (LOI) port provides connections for a built-in EIA-232 (RS-232) communications interface to a local configuration and monitoring device, typically a PC running a Microsoft

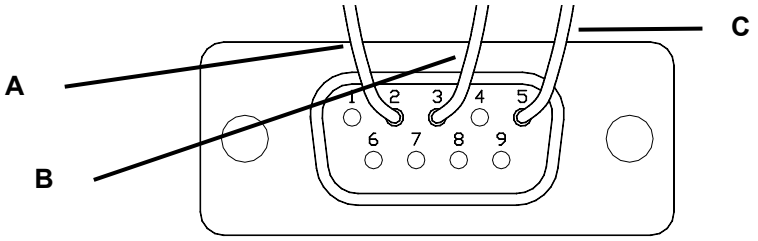
Windows® operating system. A prefabricated operator interface cable is available as an accessory. Refer to *Figure 5-2*.

The LOI port is intended for use with a PC running ROCLINK 800 software. This LOI port is compatible with EIA-232 (RS-232) levels.

Table 5-1 shows the signal routing of the Termination Board LOI port connections to the PC Comm port. Note that the FB100's EIA-232 (RS-232) transmit signal connects to the PCs receive terminal and vice versa.

Table 5-1. Local Operator Interface Port to PC Comm Port Wiring

LOI Signal	LOI Terminal	PC Signal	PC Comm Port Pin
Transmit	TX	Receive	2
Receive	RX	Transmit	3
Ready to Send	RTS		
Common	COM	Ground	5
Not Used	RP		
Common	COM		



A White
B Red
C Black (connects to LOI terminal block)

Figure 5-2. PC Comm Port Wiring

5.4 Serial Communications Card

The EIA-232 communications card meets all EIA-232 specifications for single-ended, RS-232 asynchronous data transmission over distances of up to 15 m (50 ft). The EIA-232 (RS-232) communications card provides transmit, receive, and modem control signals. The EIA-232 (RS-232) communications logic card activates Comm 2.

The EIA-232 (RS-232) communications card defaults are: 9600 baud rate, 8 data bits, 1 stop bit, no parity, 10 millisecond Key On Delay, and 10 millisecond Key Off Delay. The maximum baud rate is 19,200 bps.

The EIA-232 (RS-232) communications card signals include RX, TX, and RTS signal/control lines. Refer to *Table 5-2*.

Table 5-2. Communications Card Signals

Signals	Action
RTS	The **request to send** signals that the modem is ready to transmit.
RX	The RXD **receive data** signals that data is being received at the communications card.
TX	The TXD **transmit data** signals that data is being transmitted from the communications card.

Signal wiring connections to the communications card are made through the terminal block located on the termination board. A nine-terminal removable connector is used for the wiring of external device communications.

An EIA-232 (RS-232) communications card in the Comm 2 port enables you to switch power to external communication devices, such as a radio, to conserve power. A label on the termination board denotes the usage of each pin on the connector. *Table 5-3* displays connector signals and their functions.

Table 5-3. EIA-232 (RS-232) Communications Card Wiring

Pin	Signal	Label
9	Ring / Transmit data	TX[1]
8	Tip / Receive data	RX
7	Request to Send	RTS
3	Ground	COM[2]
2	Switched Power	B+[3]
1	Signal Common Negative	COM[2]

1 Transmit is the FB100's EIA-232 (RS-232) transmission that connects to the field device's receive.
2 COM at Pin 1 and Pin 3 are identical. They are only separated for ease of wiring.
3 Switched power is for use with an internal radio or cell phone and not for power to external devices.

5.5 Dial-up Modem Communications Card

The dial-up modem communications card supports V.22 bis/2400 baud communications with auto-answer/auto-dial features. The modem card is FCC part 68 approved for use with public-switched telephone networks (PSTNs) . A label on the termination board provides the FCC registration number and the ringer equivalent.

The optional modem communications logic card for the host port activates Comm 2.

The defaults for the dial-up modem communications card are: 2400 baud rate, 8 data bits, 1 stop bit, no parity, 10 millisecond Key On

Delay, and 10 millisecond Key Off Delay. On power up, the modem must be set up for Auto Answer. Periodic checks are made to ensure that the modem is still in Auto Answer or that it is not left off the hook after a certain period of non-communication.

The modem card interfaces to two-wire, full-duplex telephone lines using asynchronous operation at data baud rates of 1200 and 2400. The modem can be controlled using industry-standard AT command software. A 40-character command line provides AT command set, which is compatible with EIA document TR302.2/88-08006.

The initialization Config Command modem strings are:

- 1200 Dial-up Modem – ATSØØ=Ø1SØ7=Ø2
- 2400 Dial-up Modem – ATSØØ=Ø1

Signal wiring connections to the communications card are made through the terminal block located on the termination board. A nine-terminal removable connector is used for the wiring of external device communications. A label on the termination board denotes the usage of each pin on the connector.

The dial-up modem card interfaces to a PSTN line through the screw terminals with two wires. The dial-up modem card provides for a telephone interface on the host port that is capable of both answering and originating phone calls. The dial-up modem card also provides electronics that conserve power when the phone line is not in use. The dial-up modem card provides some protection from transients on the phone lines; however, if the potential for lightning damage is high, additional surge protection for the phone lines should be installed outside the FloBoss enclosure.

Table 5-4 displays the connector signals and their functions:

Table 5-4. Dial-Up Modem Communications Card Wiring

Pin	Signal	Label
9	Tip / Transmit data	TX
8	Ring / Receive data	RX

Note: Tip and Ring are the telephone interface signals.

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Chapter 6 – Dual-Variable Sensor (DVS)

In This Chapter

6.1 Dual-Variable Sensor....6-1
6.1.1 Making Process Connections....6-2
6.1.2 Configuring the DVS....6-2

This chapter describes the Dual-Variable Sensor (DVS), which provides differential pressure and static pressure inputs to the FB103 for orifice flow calculation. The DVS is **not** equipped to provide a temperature input to the FB103; this input comes directly into the FB103 through the RTD input on the termination board.

Note: Refer to technical specification DVS205 (part number D301569X012, available at *www.EmersonProcess.com/Remote*) for most-current information on the Dual Variable Sensor.

6.1 Dual-Variable Sensor

The DVS, which uses Rosemount sensor technology, measures differential pressure and absolute or gauge (static) pressure by converting the applied pressure to electrical signals and making the readings available to the processor board. The DVS is factory installed to the bottom of the FB103 enclosure.

Note: The Dual Variable Sensor has **no** user-serviceable parts. It can **only** be factory-installed or removed. Additionally, the DVS cable plugs directly in to the FB103 backplane board, and is only a factory-serviceable part.

The FB103 stores DVS readings as analog inputs. If you enable the alarm for the AI point and the DVS fails to communicate during either initialization or operation, an alarm is entered in the Alarm Log.

The DVS uses an interrupt to inform the processor board that it is ready for an update. This must occur at least once per second. The FB103 then converts this value and stores it in the proper analog input for access by other functions within the unit. If an update does not occur in the one-second interval, the sensor is re-initialized. A point fail alarm is set if the DVS does not respond to the initialization.

Pressure sensors screw into the DVS housing and provide the measurement of the static pressure and the differential pressure for orifice plate flow measurement applications.

For information on calibrating a DVS sensor, refer to *Chapter 8*.

Note: Consult your local sales representative for special ranges.

6.1.1 Making Process Connections

Piping from the meter run connects to the DVS. Both the static and differential pressure sensors connect to female ¼-18 NPT connections on the bottom of the DVS.

Note: The FloBoss is an **upstream** device, meaning that the static pressure line normally connects to the high pressure side on the sensor body (labeled "H").

⚠ Caution

Open the by-pass valve on the valve manifold prior to isolate the sensor from the process and to protect the differential cell of the DVS. This keeps one side of the differential sensor from being subjected to high pressure while the other side has no pressure applied. This is required when calibrating either differential or static pressure. Refer to *Chapter 8* for the recommended sequence.

Do NOT close the by-pass valve on the valve manifold until after process pressure has been reapplied, to protect the differential cell of the Dual-Variable Sensor. This keeps one side of the differential sensor from being subjected to high pressure while the other side has no pressure applied. Refer to *Chapter 8* for the recommended sequence.

6.1.2 Configuring the DVS

Use ROCLINK 800 configuration software to configure the DVS.

- Configure the differential pressure as analog input point number A1.
- Configure the static pressure (gauge or absolute) is configured as analog input point number A2.

You configure analog input points A1-A4 for fault mode operation using the Advanced tab of the ROCLINK 800 Analog Input Setup screen. The setting of the Action on Failure field determines whether the FB103 should hold the last known value or set to a specified fault value.

The initial pressures read are the defaults contained within the DVS. Refer to the technical specifications for the DVS205 for the initial range of the differential pressure and the static pressure. You can re-range each sensor through the calibration routines. The turndown on the range should not be greater than the turndown value listed in the technical specifications document.

The DVS also supports the conversion of values to metric units. In metric mode, both the differential pressure and the static pressure are in kPa. To enter metric mode, use ROCLINK 800. The FB103 automatically adjusts the units of the differential pressure, static

pressure, RTD, and enclosure/battery temperature, to the selected metric mode.

Note: When you select metric mode, realize that the FB103 adjusts only the Units. You must manually change all values to the proper unit of measurement.

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Chapter 7 – Pulse Interface Module

In This Chapter

7.1 Pulse Interface Module 7-1
7.1.1 Making Process Connections 7-3
7.1.2 Configuring the Pulse Interface Module 7-3

This chapter describes the Pulse Interface module, which provides pressure inputs and pulses counts to the FloBoss 104 for AGA7 flow calculation with AGA8 compressibility. The Pulse Interface module is intended for applications with rotary meters and turbine meters.

7.1 Pulse Interface Module

The primary function of the FB104 (see *Figure 7-1*) is to measure the flow of natural gas using turbine metering or rotary metering in accordance with the American Gas Association (AGA) and American Petroleum Institute (API) standards. When performing AGA7 calculations, the FB104 uses 1992 AGA8 compressibility.

The Pulse Interface module consists of two parts: a pulse counter interface and a pressure transducer.

- When used with a rotary meter, the Pulse Interface Module creates and measures electrical signals (pulses) from the rotary meter and raw pressure inputs from the pressure transducer. The module automatically interprets the direction of rotation. The module has a resolution of 1000 pulses per revolution.
- When used with a turbine input, the pressure is measured by the pressure transducer and pulses from the turbine meter are measured by the Pulse Input on the optional I/O board.

The Pulse Interface module makes the readings available to the processor board. The pressure inputs are read from an analog input, while the pulse counts are read as a pulse input.

The primary inputs used for AGA7 flow measurement are Pulse Input (PI) counts, static pressure, and temperature. A rotary meter or turbine meter provides the pulse input counts, pressure transducers provide static pressure (including auxiliary pressure) inputs, and an RTD probe provides the temperature input. After the static pressure and auxiliary pressure values are read, the flowing temperature is read. The FB104 processor reads inputs at the following rates:

- Pulse counts are read from the Pulse Interface module once per second.

- Static pressure is sampled once per second.
- Temperature is sampled and linearized once per second.

A Pressure transducer
B Pulse Interface module
C Meter adaptor

Figure 7-1. FloBoss 104 Assembly

The FB104 implements standard PI and AI alarming along with sensor and flow alarms. If the sensor fails to communicate (either during initialization or run time), the Failure bit in the Pulse Input and Analog Input alarm code is set. If you enable alarms, the alarm also appears in the Alarm Log.

The two pulse inputs in the Pulse Interface Module count pulses acquired from a rotary meter. PI1 is for clockwise (CW) rotation; PI2 is for counter-clockwise (CCW) rotation. You can use the optional pulse inputs on the termination board for other pulse input devices.

The pressure transducers provide the measurement of the line pressure (P1) and can optionally measure downstream pressure or station inlet pressure (aux P2).

The Pulse Interface module is attached to the base of the FB104 at the factory. Due to cable connections between the interface and the FB104 backplane, do **not** attempt to remove the FB104 from the Pulse Interface module.

The Pulse Interface module mounts between the bottom of the FB104 and the top of the rotary meter or turbine meter. Refer to *Chapter 2* for mounting instructions.

Note: The Pulse Interface module is not equipped to provide a temperature input to the FB104 for gas compensations in AGA7 calculations. This input should come directly into the FB104 through the RTD input on the termination board.

7.1.1 Making Process Connections

Piping from the meter run connects to the pressure transducers of the Pulse Interface module. Both the line and auxiliary pressures pipe to female ¼-18 NPT connections on the sides of the module.

⚠ Caution **Take care when removing gas lines from the sensor housing. Use one wrench to hold the sensor stationary while using a second wrench to remove the gas line. Do not allow the sensor to rotate; any rotation will damage the sensor's internal wiring.**

7.1.2 Configuring the Pulse Interface Module

Use ROCLINK 800 configuration software to configure the Pulse Interface module. Refer to the *ROCLINK 800 Configuration Software User Manual* (Part D301159X012) for instructions on configuring the meter, the analog inputs, the pulse inputs, and any other parameters for your application.

The defaults contained within the sensor are the initial pressures read. You can re-range each sensor through the calibration routines.

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Chapter 8 – Calibration

In This Chapter

8.1 Calibration (AI, RTD & Meter)....8-1
8.2 Performing a Calibration....8-1
8.3 Adjusting for Zero Shift....8-7
8.4 Verifying a Calibration....8-8

This chapter describes the processes for calibrating the AI, RTD, and Meter modules for the FB100-Series devices.

8.1 Calibration (AI, RTD & Meter)

Use ROCLINK 800 software to perform initial calibration or re-calibration, which might be required for example after you change an orifice plate in the meter run handled by the FB103.

The calibration routines support 5-point calibration, with the three mid-points calibrated in any order. Calibrate the low-end (or zero) reading first, followed by the high-end (or full-scale) reading. Calibrate the three mid-points next, if desired.

The diagnostic analog inputs for logic voltage E1, battery voltage E2, and board/battery temperature E5 are not designed to be calibrated. The diagnostic analog input for charge input can be resealed and calibrated.

The built-in inputs may be calibrated with the 5-point routine. The built-in inputs are assigned to the first three analog input points:

- Differential pressure (for AGA3) or Meter pressure (for AGA7) located at AI Point A1.
- Static pressure (for AGA3) or Auxiliary pressure (for AGA7) located at AI Point A2.
- RTD temperature located at AI Point A3.

You can then calibrate the optional analog inputs on the termination board (if you have configured the as analog inputs) using the 5 point routine.

8.2 Performing a Calibration

To perform a calibration:

1. Start ROCLINK 800 and connect to the FB100.
2. Select either **Meter** > **Calibration** or **Configure** > **I/O** > **Analog Input** > **AI Calibration** tab. The Meter Calibration screen displays.

Note: If you are calibrating the AI on the optional I/O termination board, select **Configure** > **I/O** > **Analog Input** > **AI Calibration** tab.

The current reading displays under each meter input as the Freeze Value. The FB100 uses these values in the flow calculations while calibrating the points.

3. Click **Freeze**.

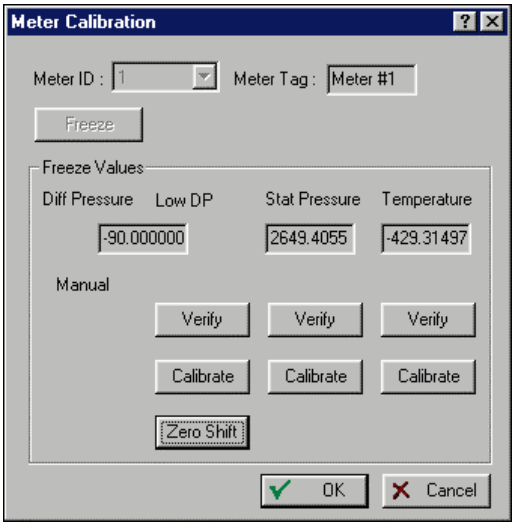

Figure 8-1. Meter Calibration (FloBoss 103 Shown)

4. If you are calibrating a **pressure input**, read the following Caution, and then **isolate** the pressure sensors from the process.

   If you are calibrating a RTD temperature input, proceed to Step 6. If you are calibrating the optional AI (AI Point Number B1), proceed to Step 8.

⚠ Caution **Open the by-pass valve on the valve manifold prior to isolating the sensor from the process, to protect the differential cell of the Dual-Variable Sensor. This keeps one side of the differential sensor from being subjected to high pressure while the other side has no pressure applied. This is required when calibrating either differential or static pressure. Refer to *Figure 8-2* for the recommended sequence.**

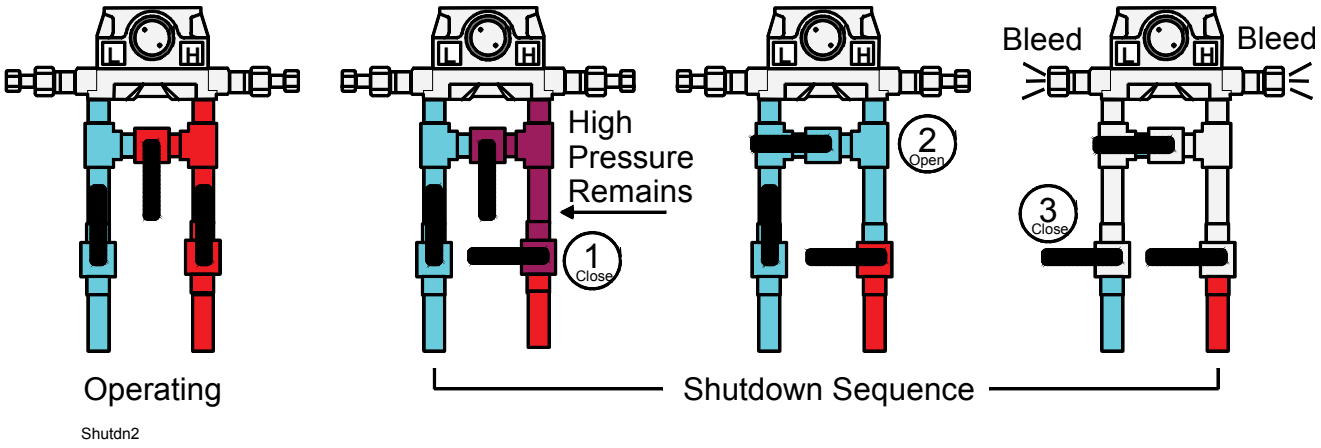

Figure 8-2. Removing the DVS from Service

5. If you are calibrating a **pressure input**, set up the pressure calibrator and make the necessary connections to the DVS. Refer to *Figure 8-3* for the line orientation during the calibration.

⚠ Caution **To protect the differential cell of the Dual-Variable Sensor, do not exceed the differential pressure range on the DVS. Refer to the technical specifications for the DVS205 (form DVS205, part number D301569X012, listed in the *Additional Technical Information* section in *Chapter 1*.**

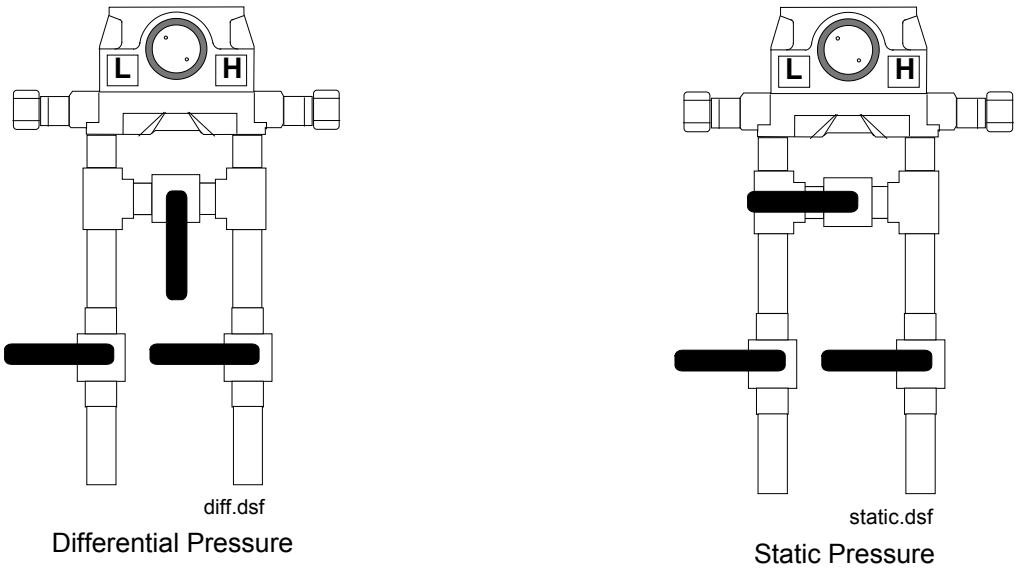

Figure 8-3. Pressure Calibration Open/Close Orientation

6. If you are calibrating a **temperature input**, disconnect the RTD sensor and connect a decade box (or comparable equipment) to the RTD terminals of the FB100.

7. Click **Calibrate** under the desired input to calibrate Diff Press, Stat Press, or Temperature. The Set Zero calibration window displays.

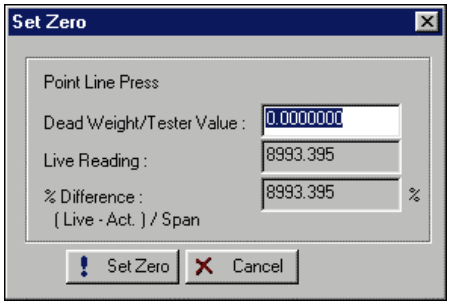

Figure 8-4. Set Zero Calibration Example

8. Apply the **low (zero) value**. For a pressure input, this would typically be open to atmosphere.

9. Enter the applied value in the **Dead Weight / Tester Value** field of the Set Zero dialog. Refer to *Figure 8-4*. For static pressure on an absolute-pressure device, remember to enter the actual current atmospheric pressure, such as 14.73 psi.

10. When the displayed Live Reading is stable, click **Set Zero** to calibrate the zero reading. The Set Span window displays.

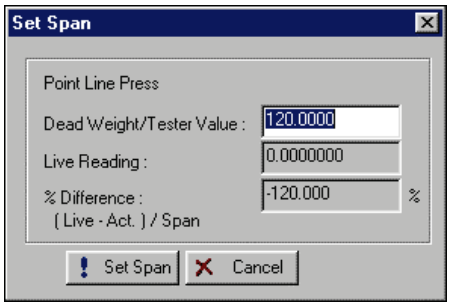

Figure 8-5. Set Span

11. Apply the desired **high value** to the input (the top end of the expected operating range). To maintain rated accuracy, be sure to observe the turndown limits.

12. Enter the applied value in the **Dead Weight / Tester Value** field of the Set Span dialog. For static pressure on an absolute-pressure device, add the actual atmospheric pressure, such as 300 + 14.73.

13. When the Live Reading is stable, click **Set Span** to calibrate the high reading. The Set Midpoint 1 windown displays.

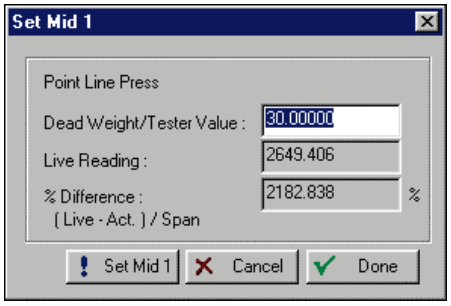

Figure 8-6. Set Midpoint 1

14. If you are performing a **two-point** calibration, click **Done**. Calibration for this input is complete.
15. To calibrate midpoints, apply the desired pressure or temperature and enter the applied value in the **Dead Weight / Tester Value** field. Note that you can calibrate the midpoints in **any** order.
16. When the Live Reading is stable, click **Set Mid 1** to calibrate this reading. The Set Midpoint 2 window displays.

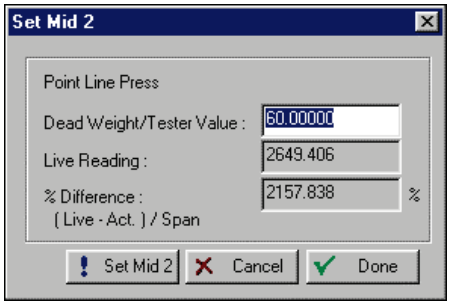

Figure 8-7. Set Midpoint 2

17. If you are performing a **three-point** calibration, click **Done**. Calibration for this input is complete.
18. To calibrate additional Midpoints, apply the desired pressure or temperature and enter the applied value in the **Dead Weight / Tester Value** field.
19. When the Live Reading is stable, click **Set Mid 2** to calibrate this reading. The Set Midpoint 3 window displays.

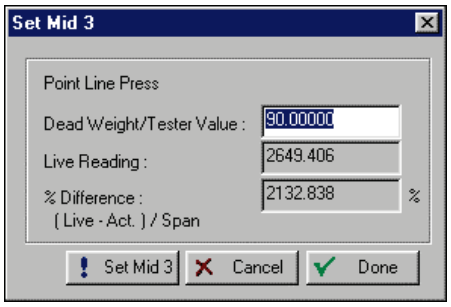

Figure 8-8. Set Midpoint 3

20. If you are performing a **four-point** calibration, click **Done**. Calibration for this input is complete.

21. To calibrate a third midpoint, apply the desired pressure or temperature and enter the applied value in the **Dead Weight / Tester Value** field.

22. When the Live Reading is stable, click **Set Mid 3** to calibrate this reading. The calibration is complete, and the display returns to the Meter Calibration window.

23. When the calibration for a selected point is complete, you have the choice to calibrate another input, to verify the calibration or to close the calibration screen.

When the calibration is complete and you calibrated **pressure inputs**, read the following Caution and return the Dual-Variable Sensor to service.

⚠ Caution **Do NOT close the by-pass valve on the valve manifold until after process pressure has been reapplied, to protect the differential cell of the Dual-Variable Sensor. This keeps one side of the differential sensor from being subjected to high pressure while the other side has no pressure applied. Refer to *Figure 8-9*.**

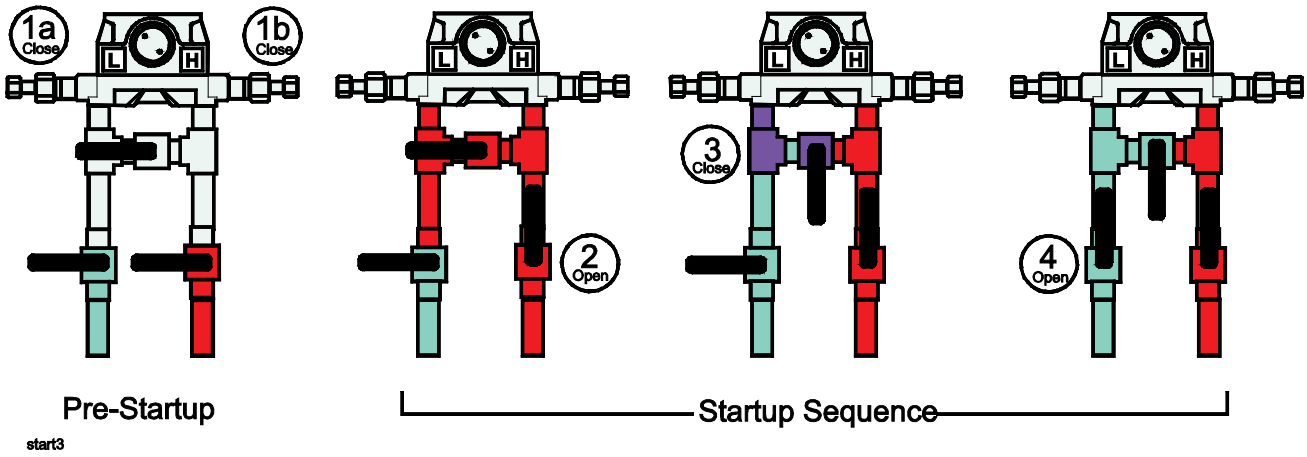

Figure 8-9. Returning the DVS to Service

Note: If you calibrated the Differential Pressure input, refer to *Section 8.3, Adjusting for Zero Shift,* before you complete the last step.

24. Click **OK** to close the calibration window, cancel freeze values (unfrozen) and enable live readings for use in the flow calculations. The Event Log records all calibration settings that were changed.

8.3 Adjusting for Zero Shift

If desired, use the zero shift procedure after calibrating the differential pressure input for the FB103. The FB103 calibrates differential pressure without applying line pressure to the sensor. When you connect the sensor back to the process after calibration, a shift in the differential pressure can occur due to the influence of the line pressure. You can cancel out this effect with a zero shift adjustment.

To check or adjust for zero shift, leave the sensor by-pass valve open (to simulate a no-flow condition), with either line pressure or a normal operating static pressure from the calibrator applied to the sensor. This applies the same pressure to both sides of the differential pressure diaphragm to give a zero differential pressure reading.

Perform the following steps:

1. Ensure ROCLINK 800 software is connected to the FB104 and is running the calibration procedure.

2. If you already released the meter inputs from the freeze condition, click **Freeze**. This displays the Meter Calibration window (see *Figure 8-11*).

3. Under the Diff Press input, click **Zero Shift**. The Set Zero Shift window displays.

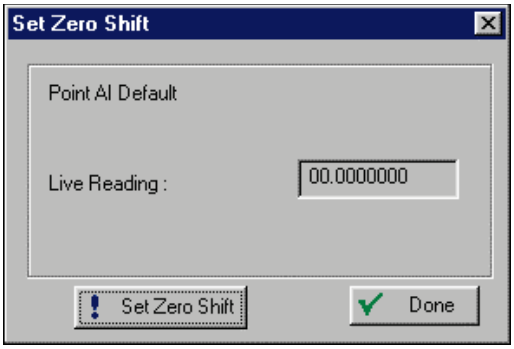

Figure 8-10. Set Zero Shift

4. Review the value in the **Live Reading** field. If it is not zero, you need to perform a zero shift correction.

5. Click **Set Zero Shift** to adjust the Zero Shift. The value in the Live Reading field should change to zero.

6. Click **Done**. The Meter Calibration window displays.

7. Click **OK** to close the Meter Calibration window, cancel the freeze values, and enable the FB100 to begin using live readings for the flow calculations.

8.4 Verifying a Calibration

ROCLINK 800 software can verify the calibration to check if the DVS requires re-calibration. To verify the calibration:

1. Start ROCLINK 800 software and connect to the FB100.
2. Select **Meter** > **Calibration**.
3. Click **Freeze**. The Meter Calibration window displays. The current reading displays under each meter input as the Freeze Value. The FB100 these values in the flow calculations while verifying the points.

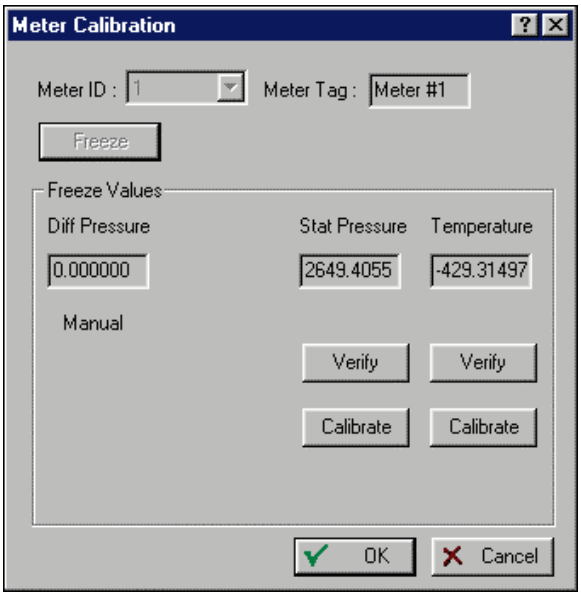

Figure 8-11. Meter Calibration Window

⚠ Caution **Open the by-pass valve on the valve manifold prior to isolating the sensor from the process, to protect the differential cell of the Dual-Variable Sensor. This keeps one side of the differential sensor from being subjected to high pressure while the other side has no pressure applied. This is required when calibrating either differential or static pressure. Refer to *Figure 8-2* for the recommended sequence.**

4. While observing the previous Caution, apply the desired **pressure** setting to the input.
5. Click **Verify** under the input to calibrate. The Verify screen displays.

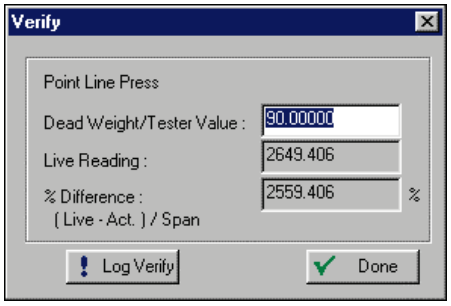

Figure 8-12. Verify Calibration

6. To log the Tester Value and the Live Reading to the Event Log as a record of the verification, click **Log Verify**.
7. Click **Done**. The Meter Calibration screen displays.
8. Continue to verify all required **pressures/values**.
9. When the verification for a selected point is complete, you have the choice to verify another input, perform a calibration, or close the calibration screen. When complete, read the following Caution and connect the **Dual-Variable Sensor** back to the process.

⚠ Caution **Do NOT close the by-pass valve on the valve manifold until after process pressure has been reapplied, to protect the differential cell of the Dual-Variable Sensor. This keeps one side of the differential sensor from being subjected to high pressure while the other side has no pressure applied. Refer to *Figure 8-9*.**

10. Click **OK** to close the calibration window, to cancel freeze values (unfrozen), and to enable live readings for use in the flow calculations. The Event Log records all calibration settings that were changed.

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Chapter 9 – Troubleshooting

In This Chapter

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This chapter provides generalized guidelines for troubleshooting the FB100. Perform the procedures in this chapter before you remove power for any reason, after you restore power, and if you disassemble the FB100.

The following tools are required for troubleshooting:

- Personal computer (PC) running Microsoft® Windows® operating system
- ROCLINK 800 software.
- Flat-head and Philips screwdrivers.

9.1 Troubleshooting Guidelines

When you are attempting to diagnose a problem with an FB100:

- Remember to write down what steps you have taken.
- Save the configuration and log data (see *Section 9.3.1*).
- Note the order in which you remove components.
- Note the orientation of the components before you alter or remove them.
- Read and follow all Cautions in this manual.

When you are done troubleshooting, perform the restart and reconfiguration procedure in *Section 9.3.3*.

9.2 Troubleshooting Checklists

9.2.1 Dial-up Modem

If you are experiencing troubles with an internal **dial-up modem**:

- Check to make sure you've applied power to the FB100. Check the ON/OFF jumper, the wiring connections at CHG+ and CHG-, and the wiring at the power source.
- Check the wiring to the modem (see *Chapter 5)*.
- Check the communication port settings in ROCLINK 800. Refer to *ROCLINK 800 Configuration Software User Manual* (Part D301159X012).
- Check the modem INIT string as displayed in the communication port settings in ROCLINK 800. Refer to *ROCLINK 800 Configuration Software User Manual* (Part D301159X012).

9.2.2 Serial Communications

If you are experiencing troubles with a **serial communications** connection (LOI, EIA-232, or EIA-485):

- Check to make sure you have applied power to the FB100. Check the ON/OFF jumper, the wiring connections at CHG+ and CHG-, and the wiring at the power source.
- Check the wiring to the termination block or connector (see *Chapter 5)*.
- Check the communication port settings in ROCLINK 800. Refer to *ROCLINK 800 Configuration Software User Manual* (Part D301159X012).

9.2.3 Optional I/O

If you are experiencing troubles with an optional **I/O point** (Analog Input, Analog Output, Discrete Input, Discrete Output, or Pulse Input):

- Check (using ROCLINK 800) to see how the channel is configured.
- If the configuration looks correct, then simulate an input (within the range of the input) or force an output to be produced using ROCLINK 800 software.
- If the types of I/O available for configuration do not match the type of I/O wired to the I/O terminations, check the I/O Setup screen. Refer to *Chapter 4* for wiring schematics and instructions.
- If an input channel is in question, you may be able to use one of the outputs (known to be in working order) to simulate the required input. Likewise, if an output channel is in question, you may able to connect it to a working input channel and check the results.

Note: No field repair or replacement parts are associated with the I/O termination points.

9.2.4 Software Issues

If you are experiencing problems with the FB100 that appear to be **software**-related, try resetting the FB100.

- Use a warm start to restart without losing configuration or log data. To perform a warm start, open ROCLINK 800 software, connect to the FB100, and select **ROC** > **Flags**. Refer to *ROCLINK 800 Configuration Software User Manual* (Part D301159X012).
- Use a cold start to restart without a portion of the configuration, log data, or programming that may be the trouble. To perform a cold start, open ROCLINK 800 software, connect to the FB100, and select **ROC** > **Flags**. Refer to *ROCLINK 800 Configuration Software User Manual* (Part D301159X012).
- If a warm start and a cold start do not allow you to connect and you cannot connect to the FB100 using the LOI port, use the RESET jumper on the FB100 and cycle power to restore the LOI Communications parameters to factory defaults (see *Section 9.3.2)*.

Note: If these methods do not resolve the problem, contact your local sales representative.

9.2.5 Power Issues

If you are experiencing trouble **powering** up the FB100:

- Check the ON/OFF jumper, the wiring connections at CHG+ and CHG-, and the wiring at the power source.
- Check the batteries for voltage. The battery pack contains three D-size lead-acid batteries providing 2.5 Amp-hours of current at 6.2 volts nominal. If the batteries are below the nominal voltage, replace them. Refer to *Chapter 3*.

9.2.6 Dual-Variable Sensor (FB103)

If your Dual-Variable Sensor (DVS) is not responding:

1. Start ROCLINK 800, log in, and connect to the FB100.
2. Select **Configure** > **I/O** > **AI Points**.
3. Select **Analog Input 1**.
4. Ensure that the DVS is not in manual mode by setting the **Scanning** field to **Enabled**.
5. If the DVS is still not responding, reset the DVS to factory defaults to clear invalid calibration data.

6. If the input shows a Point Fail alarm, then the sensor is not communicating with the FB100.

The DVS contains **no** user-serviceable or user-replaceable parts. Return the FB100 to your local sales representative for repair or replacement.

Note: Do not attempt to disconnect the DVS from the FB100. This is a factory-approved process only.

9.2.7 Pulse Interface Module (FB104)

If your Pulse Interface module is not responding:

1. Start ROCLINK 800, log in, and connect to the FB100.
2. Select **Configure** > **I/O** > **AI Points**.

   Select **Analog Input 1** or **2**. Analog Input 1 is the Meter Pressure; Analog Input 2 is the Auxiliary pressure. If the Auxiliary pressure is not installed, this point will show inactive.

   Ensure that the Pulse Interface Module is not in manual mode by setting the **Scanning** field to **Enabled**.
3. Go to the **Utilities** > **Pulse Interface Module Data** screen in ROCLINK 800 software and use the diagnostics provided on the screen. Refer to the *ROCLINK 800 Configuration Software User Manual* (Part D301159X012) for more information on this screen.

The Pulse Interface module contains **no** user-serviceable or user-replaceable parts. Return the FB100 to your local sales representative for repair or replacement.

Note: Do not attempt to disconnect the Pulse Interface module from the FB104. This is a factory-approved process only.

9.2.8 Resistance Temperature Detector

If you are experiencing troubles with the Resistance Temperature Detector (RTD):

- Verify (using ROCLINK 800) that the RTD point is configured as Analog Input 3.
- Verify that the wiring to the RTD terminations is correct. Refer to *Chapter 4*.
- Verify that the user-supplied RTD probe is not faulty. Refer to the instructions that accompanied the RTD probe.

The RTD contains **no** user-serviceable or user-replaceable parts. If you are certain that the RTD is not at fault, teturn the FB100 to your local sales representative for repair or replacement.

9.3 Procedures

9.3.1 Preserving Configuration and Log Data

Perform this backup procedure before your remove power from the FB100 for repairs, troubleshooting, removing or adding components, or upgrades. This procedure preserves the current flow computer configuration and log data held in RAM.

⚠ Caution

When installing equipment in a hazardous area, ensure that all components are approved for use in such areas. Check the product labels. Change components only in an area known to be non-hazardous. Performing these procedures in a hazardous area could result in personal injury or property damage.

To avoid circuit damage when working inside the unit, use appropriate electrostatic discharge precautions, such as wearing a grounded wrist strap.

1. Start ROCLINK 800, log in, and connect to the FB100.
2. Ensure that the configuration is saved in flash memory by performing a Save to Flash Memory (**ROC** > **Flags**). This saves all configuration settings, including the current states of the ROC Flags and calibration values.
3. Select **ROC** > **Collect Data** and select the All checkbox. Click **OK**. This action saves event logs, alarm logs, report data, and history. You can specify your own file name and path if desired.
4. Select **File** > **Save Configuration**. The Save As dialog box appears.
5. Type the desired file name for the backup file (or use the default).
6. Click **Save**. ROCLINK 800 saves the file to the default directory C:/Program Files/ROCLINK 800/Data (unless you changed the directory).

9.3.2 Resetting the FB100

The Reset jumper is located on the LCD (if installed) or on the Battery Charger board. Use the reset jumper to perform a special type of cold start, in which the power-up re-establishes the FB100 to a known operating point. This includes re-initializing the Communication Ports to the factory default configuration.

This type of reset restores the communications ports to the factory configuration defaults. Some user-entered configuration parameters may be lost. Therefore, back up any required data before you perform this reset. Refer to *Section 9.3.1* and perform the backup procedure.

Note: This cold start **does not** include any of the clearing options available in a cold start you perform using ROCLINK 800.

1. Unscrew the front end cap cover (LCD end).
2. Place the reset jumper (located on the LCD, if installed, or on the Battery Charger board at J2) in the **RST** position.
3. Cycle power.
4. Remove the reset (RST) jumper and install it in the normal (**NORM**) position.

   Note: It is good practice to lubricate the end cap covers each time you remove them for maintenance.

5. Replace the front end cap cover (LCD end). Screw the cover on until metal contacts metal. Do not over-tighten the cover.
6. Refer to *Section 9.3.3* to restart and reconfigure the FB100.

This reset action loads the factory default values into the communication ports.

9.3.3 Restarting and Reconfiguring

After you remove power from the FB100 to perform maintenance or repair as needed, use this procedure to start the FB100 and reconfigure your data. The procedure assumes you are using ROCLINK 800.

⚠ Caution

Ensure all input devices, output devices, and processes remain in a safe state upon restoring power. An unsafe state could result in property damage.

When installing equipment in a hazardous area, ensure that all components are approved for use in such areas. Check the product labels. Change components only in an area known to be non-hazardous. Performing these procedures in a hazardous area could result in personal injury or property damage.

1. Restore power to the FB100 by inserting the **CHG+ / CHG-** power terminal block.
2. Start ROCLINK 800, log in, and connect to the FB100.
3. Verify that the configuration is correct. If it is not, continue by configuring the required items. If major portions or the entire configuration needs to be reloaded, perform the remaining steps.
4. Select **File** > **Download**.
5. From the **Open** dialog box, select the backup configuration file (has extension *.800).

6. Select the portions of the configuration you want to download (restore).
7. Click **Download** to restore the configuration.

9.3.4 Connecting the Termination Board to the Backplane

Older FloBoss 103 units were shipped with the termination board connected to the backplane through a 34-pin interface connector. Your FB103 may have a shrouded connector which ensures the correct polarity. If you must disconnect the termination board from the backplane **for any reason**, be careful to re-connect the shrouded connector using the following steps.

1. Insert the 34-pin interface connector into the backplane connector. Make sure that the connector shell faces away from the backplane and toward the termination board. See *Figure 9-1*.
2. Once the connection has been made to the backplane, use the connector shell to guide the pins of the 34-pin interface connector into the termination board connector. See *Figure 9-2*. Use caution; you will not be able to see the connection being made within the housing.

Note: If you do not re-assemble the 34-pin interface connector and boards as directed, the pins may misalign, may not fully connect, and cause the FB103 to function incorrectly. Depending on which connections are made, the unit may appear to be working if the LCD is present.

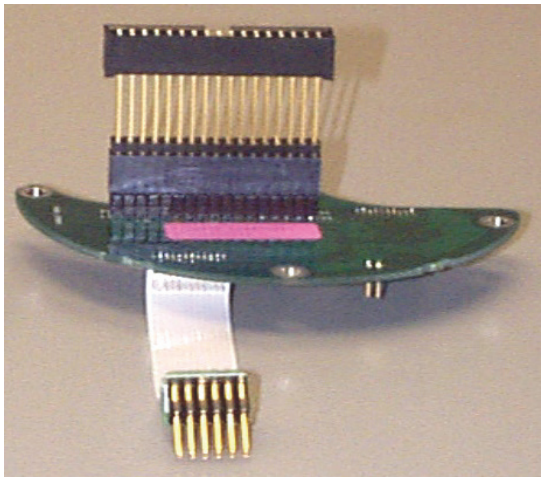
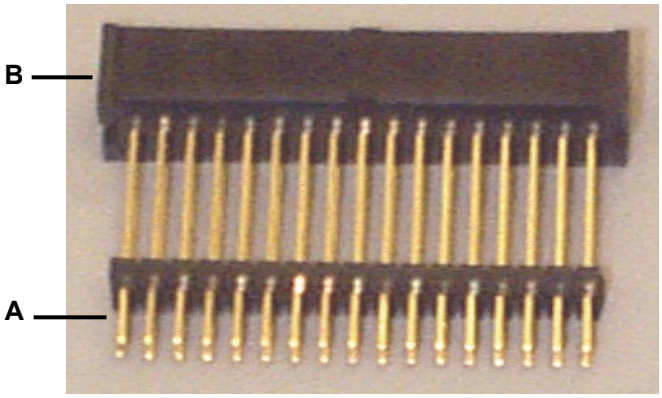


Figure 9-1. Backplane with 34-Pin Interface Connector



A Attach this end to backplane first.
B Attach this end to termination board second

Figure 9-2 . 34-Pin Interface Connector

Appendix A – Glossary

Note: This is a generalized glossary of terms. Not all the terms may necessarily correspond to the particular device or software described in this manual. For that reason, the term "ROC" is used to identify all varieties of Remote Operations Controllers (including ROC800-Series, ROC800L, DL8000, FloBoss™ 107, and FloBoss™ 100-Series). Refer to *Measurement Units, Symbols, and Abbreviations* (Form A6302) for additional information.

A

A/D	Analog to Digital signal conversion.
ABS	Acrylonitrile Butadiene Styrene.
ADC	Analog to Digital Converter. Used to convert analog inputs (AI) to a format the flow computer can use.
AGA	American Gas Association. A professional organization that oversees the AGA3 (orifice), AGA5 (heating value), AGA7 (turbine), AGA8 (compressibility), and AGA11 (ultrasonic) gas flow calculation standards. See http://www.aga.org.
AWG	American Wire Gauge.
AI	Analog Input.
AO	Analog Output.
Analog	Analog data is represented by a continuous variable, such as an electrical current signal.
AP	Absolute Pressure.
API	American Petroleum Institute. See http://www.api.org.
Area	A user-defined grouping of database entities.
ASCII	American (National) Standard Code for Information Interchange.
Attribute	A parameter that provides information about an aspect of a database point. For example, the alarm attribute is an attribute that uniquely identifies the configured value of an alarm.

B

BMV	Base Multiplier Value, used in AGA7 (turbine) calculations.
BPS	Bits Per Second, associated with baud rate.
BTU	British Thermal Unit, a measure of heat energy.
Built-in I/O	I/O channels that are fabricated into the ROC and do not require a separate option. Also called "on-board" I/O.

C

C1D2	Class 1, Division 2 hazardous area
CMOS	Complementary Metal Oxide Semiconductor, a type of microprocessor used in a ROC.
Coil	Digital output, a bit to be cleared or set.
COL	Ethernet Packet Collision.
COM	Communications port on a personal computer (PC).

C (continued)

COMM Communications port on a ROC used for host communications. .

Note: On FloBoss 500-Series and FloBoss 407s, COMM1 is built-in for RS-232 serial communications.

Comm Module Module that plugs into a ROC to provide a channel for communications via a specified communications protocol, such as EIA-422 (RS-422) or HART.

CF Compare Flag; stores the Signal Value Discrete (SVD).

Configuration Refers either to the process of setting up the software for a given system or the result of performing this process. The configuration activity includes editing the database, building schematic displays and reports, and defining user calculations. Typically, the software setup of a device that can often be defined and changed. Can also mean the hardware assembly scheme.

Configuration Tree In ROCLINK 800, the graphical display that appears when a configuration file opens. It is a hierarchical branching ("tree-style") method for navigating within the configuration screens.

CPU Central Processing Unit.

CRC Cyclical Redundancy Check error checking.

Crosstalk The amount of signal that crosses over between the receive and transmit pairs, and signal attenuation, which is the amount of signal loss encountered on the Ethernet segment.

CSA Canadian Standards Association. See http://www.csa.ca.

CSMA/CD Carrier Sense Multiple Access with Collision Detection.

CTS Clear to Send modem communications signal.

D

D/A Digital to Analog signal conversion.

DB Database.

dB Decibel. A unit for expressing the ratio of the magnitudes of two electric signals on a logarithmic scale.

dBm Power ratio in decibels (dB), referenced to one milliwatt (mW), also known as dBmW.

DCD **Data Carrier Detect** modem communications signal. In addition, **Discrete Control Device** – A discrete control device energizes a set of discrete outputs for a given setpoint and matches the desired result against a set of discrete inputs (DI).

DCE Data Communication Equipment.

Deadband A value that is an inactive zone above the low limits and below the high limits. The purpose of the deadband is to prevent a value (such as an alarm) from being set and cleared continuously when the input value is oscillating around the specified limit. This also prevents the logs or data storage location from being over-filled with data.

Device Directory In ROCLINK 800, the graphical display that allows navigation through the PC Comm Ports and ROC Comm Ports setup screen.

DI Discrete Input.

Discrete Input or output that is non-continuous, typically representing two levels (such as on/off).

DMM Digital multimeter.

DO Discrete Output.

Download The process of sending data, a file, or a program from a PC to a ROC.

DP Differential Pressure.

DRN Distributed RTU Network, in which two or more remotely distributed RTU devices (RRTUs) are wirelessly connected in a peer-to-peer network to share data.

D (continued)

DRTU	A primary component of the Distributed RTU Network, consisting of a FB107 chassis housing a focused functionality CPU and a Network Radio module (NRM). The DRTU collects process variables from one or more wellheads and transmits the signals throughout the designed network.
DSR	Data Set Ready modem communications signal.
DTE	Data Terminal Equipment.
DTR	Data Terminal Ready modem communications signal.
Duty Cycle	Proportion of time during a cycle that a device is activated. A short duty cycle conserves power for I/O channels, radios, and so on.
DVM	Digital voltmeter.
DVS	Dual-Variable Sensor. A device that provides static and differential pressure inputs to a ROC.

E

EDS	Electronic Static Discharge.
EEPROM	Electrically Erasable Programmable Read-Only Memory, a form of permanent memory on a ROC.
EFM	Electronic Flow Metering or Measurement.
EIA-232 (RS-232)	Serial Communications Protocol using three or more signal lines, intended for short distances. Concerning RS232D and RS232C, the letters C or D refer to the physical connector type. D specifies the RJ-11 connector where a C specifies a DB25 type connector.
EIA-422 (RS-422)	Serial Communications Protocol using four signal lines.
EIA-485 (RS-485)	Serial Communications Protocol requiring only two signal lines. Can allow up to 32 devices to be connected together in a daisy-chained fashion.
EMF	Electro-Motive Force.
EMI	Electro-Magnetic Interference.
ESD	Electro-Static Discharge.
EU	Engineering Units. Units of measure, such as MCF/DAY.

F

FCC	Federal Communications Commission. See http://www.fcc.gov.
Firmware	Internal software that is factory-loaded into a form of ROM. In a ROC, the firmware supplies the software used for gathering input data, converting raw input data values, storing values, and providing control signals.
FlashPAC module	ROM and RAM module for a ROC300-Series unit that contains the operating system, applications firmware, and communications protocol.
Flash ROM	A type of read-only memory that can be electrically re-programmed. It is a form of permanent memory (requires no backup power). Also called Flash memory.
FloBoss	A microprocess-based device that provides flow calculations, remote monitoring, and remote control. A FloBoss is a type of ROC.
FM	Factory Mutual.
Force	Write an ON/OFF, True/False, or 1/0 value to a coil.
FOUNDATION™ Fieldbus	An open architecture for information integration, managed by the Fieldbus Foundation (www.fieldbus.org).
FPV	Compressibility Factor.

F (continued)

FSK	Frequency Shift Keypad.
FST	Function Sequence Table, a type of user-written program in a high-level language designed by Emerson Process Management's Flow Computer Division.
Ft	Foot or feet.

G

GFA	Ground Fault Analysis.
GHz	Gigahertz, 10^9 cycles per second
GND	Electrical ground, such as used by the ROC's power supply.
GP	Gauge Pressure.

H

H1	A Foundation Fieldbus protocol operating at 31.25 kbit/s that interconnects field devices (such as sensors or I/O devices).
HART	Highway Addressable Remote Transducer.
Holding Register	Analog output number value to be read.
HSE Protocol	High Speed Ethernet protocol; a communications protocol operating at 100 Mbit/s used to integrate high-speed controllers (or servers) connected via Ethernet.
Hw	Differential pressure.
Hz	Hertz.

I, J

IC	Integrated Circuit. Also, Industry Canada (more recently known as Measurement Canada), an organization that grants custody transfer approvals on certain ROC units.
ID	Identification.
IEC	Industrial Electrical Code or International Electrotechnical Commission. See http://www.iec.ch.
IEEE	Institute of Electrical and Electronic Engineers. A professional organization that, in conjunction with the International Standards Organization (ISO), establishes and maintains the Open System Interconnection (OSI) reference model and an international standard for the organization of local area networks (LANs). Refer to http://www.ieee.org.
IMV	Integral Multiplier Value, used in AGA3 (orifice) calculations.
Input	Digital input, a bit to be read.
Input Register	Input numeric value to be read.
Local Port	Also LOI; the serial EIA-232 (RS-232) port on the ROC through which local communications are established, typically for configuration software running on a PC.
I/O	Input/Output.
I/O Module	Module that plugs into an I/O slot on a ROC to provide an I/O channel.
IRQ	Interrupt Request. Hardware address oriented.
ISO	International Standards Organization. See http://www.iso.ch.
IV	Integral Value.

K

KB Kilobytes.

kHz KiloHertz.

L

LCD Liquid Crystal Display.

LDP Local Display Panel, a display-only device that plugs into ROC300-Series units (via a parallel interface cable) used to access information stored in the ROC.

LED Light-Emitting Diode.

Logical Number The point number the ROC and ROC Plus protocols use for I/O point types are based on a physical input or output with a terminal location; the point numbers for all other point types are “logical” and are simply numbered in sequence.

LNK Ethernet has linked.

LOI Local Operator Interface (or Local Port). Refers to the serial EAI-232 (RS-232) port on the ROC through which local communications are established, typically for configuration software running on a PC.

LPM Lightning Protection Module; a device that provides lightning and power surge protection for ROCs.

LRC Longitudinal Redundancy Checking error checking.

M

m Meter.

mA Milliamp(s); one thousandth of an ampere.

MAC Address Media Access Control Address; a hardware address that uniquely identifies each node of a network.

Manual mode For a ROC, indicates that the I/O scanning has been disabled.

MAU Medium Attachment Unit.

MCU Master Controller Unit.

Modbus A popular device communications protocol developed by Gould-Modicon.

MPU Micro-Processor Unit.

mm Millimeter.

MMBTU Million British Thermal Units.

msec Millisecond, or 0.001 second.

MVS Multi-Variable Sensor. A device that provides differential pressure, static pressure, and temperature inputs to a ROC for orifice flow calculations.

mV Millivolts, or 0.001 volt.

mW Milliwatts, or 0.001 watt.

N

NAP Network Access Point; the point in the distributed RTU network at which ROCLINK 800

NEC National Electrical Code.

NEMA National Electrical Manufacturer’s Association. See *http://www.nema.org*.

N (continued)

Node	A basic structural component of the Distributed RTU Network. A node (usually a FB107 chassis housing a focused-functionality CPU and a Network Radio module) provides a data collection point that wirelessly transmits data throughout the designed network.
NRM	Network Radio module; a module used in both the FloBoss 107 and ROC00-Series based devices to wirelessly transmit information throughout the distributed RTU network.

O

OH	Off-Hook modem communications signal.
Off-line	Accomplished while the target device is not connected (by a communications link). For example, “off-line configuration” refers to configuring an electronic file that is later loaded into a ROC.
Ohms	Units of electrical resistance.
On-line	Accomplished while connected (by a communications link) to the target device. For example, “on-line configuration” refers to configuring a ROC800-Series unit while connected to it, so that you can view the current parameter values and immediately load new values.
Opcode	Type of message protocol the ROC uses to communicate with the configuration software, as well as host computers with ROC driver software.
Operator Interface	Also LOI or Local Port; the serial EIA-232 (RS-232) port on the ROC through which local communications are established, typically for configuration software running on a PC.
Orifice meter	A meter that records the flow rate of gas through a pipeline. The flow rate is calculated from the pressure differential created by the fluid passing through an orifice of a particular size and other parameters.

P, Q

Parameter	A property of a point that typically can be configured or set. For example, the Point Tag ID is a parameter of an Analog Input point. Parameters are normally edited by using configuration software running on a PC.
PC	Personal Computer.
Pf	Flowing pressure.
P/DP	Pressure/Differential Pressure.
PI	Pulse Input.
PID	Proportional, Integral, and Derivative control feedback action.
PIT	Periodic Timer Interrupt.
PLC	Programmable Logic Controller.
Point	Software-oriented term for an I/O channel or some other function, such as a flow calculation. Points are defined by a collection of parameters.
Point Number	The physical location of an I/O point (module slot and channel) as installed in the ROC.
Point Type	Defines the database point to be a specific type of point available to the system. The point type determines the basic functions of a point.
Preset	Number value previously determined for a register.
PRI	Primary PID control loop.
Protocol	A set of standards that enables communication or file transfers between two computers. Protocol parameters include baud rate, parity, data bits, stop bit, and the

	type of duplex.
PSTN	Public Switched Telephone Network.
PT	Process Temperature.
PTT	Push-to-Talk signal.
Pulse	Transient variation of a signal whose value is normally constant.
Pulse Interface module	A module that provides line pressure, auxiliary pressure, and pulse counts to a ROC.
PV	Process Variable or Process Value.

R

Rack	A row of slots on a ROC into which I/O modules can be plugged. Racks are given a letter to physically identify the location of an I/O channel (such as “A” for the first rack). Built-in I/O channels are assigned a rack identifier of “A” while diagnostic I/O channels are considered to be in “E” rack.
RAM	Random Access Memory. RAM is used to store history, data, most user programs, and additional configuration data.
RBX	Report-by-exception. RBX always refers to Spontaneous RBX in which the ROC contacts the host to report an alarm condition.
RR	Results Register; stores the Signal Value Analog (SVA).
RFI	Radio Frequency Interference.
RI	Ring Indicator modem communications signal.
ROC	Remote Operations Controller microprocessor-based unit that provides remote monitoring and control.
ROCLINK 800	Microsoft® Windows®-based software used to configure functionality in ROC units.
ROM	Read-only memory. Typically used to store firmware. Flash memory.
Rotary Meter	A positive displacement meter used to measure flow rate, also known as a Roots meter.
RTC	Real-Time Clock.
RTD	Resistance Temperature Detector.
RTS	Ready to Send modem communications signal.
RTU	Remote Terminal Unit.
RTV	Room Temperature Vulcanizing, typically a sealant or caulk such as silicon rubber.
RS-232	Serial Communications Protocol using three or more signal lines, intended for short distances. Also referred to as the EIA-232 standard.
RS-422	Serial Communications Protocol using four signal lines. Also referred to as the EIA-422 standard.
RS-485	Serial Communications Protocol requiring only two signal lines. Can allow up to 32 devices to be connected together in a daisy-chained fashion. Also referred to as the EIA-485 standard.
RX or RXD	Received Data communications signal.

S

SAMA	Scientific Apparatus Maker’s Association.
SCADA	Supervisory control and data acquisition; referring to a computer system that monitors and controls oil and gas pipeline systems.

S (continued)

Script	An uncompiled text file (such as keystrokes for a macro) that a program interprets in order to perform certain functions. Typically, the end user can easily create or edit scripts to customize the software.
Soft Points	A type of ROC point with generic parameters that can be configured to hold data as desired by the user.
SP	Setpoint, or Static Pressure.
SPI	Slow Pulse Input.
SPK	Speaker.
SRAM	Static Random Access Memory. Stores data as long as power is applied; typically backed up by a lithium battery or supercapacitor.
SRBX	Spontaneous Report-By-Exception. SRBX always refers to Spontaneous RBX in which the ROC contacts the host to report an alarm condition.
SVA	Signal Value Analog. Stored in the Results Register, it is the analog value that is passed between functions in an FST.
SVD	Signal Value Discrete. Stored in the Compare Flag, it is the discrete value that is passed down the sequence of functions in an FST.
System Variables	Configured parameters that describe the ROC; set using ROCLINK software.

T

T/C	Thermocouple Input.
TCP/IP	Transmission Control Protocol/Internet Protocol.
TDI	Time Duration Input.
TDO	Time Duration Output.
Tf	Flowing temperature.
TLP	Type (of point), Logical (or point) number, and Parameter number.
TX or TXD	Transmitted Data communications signal.
Turbine meter	A device used to measure flow rate and other parameters.

U

Upload	Send data, a file, or a program from the ROC to a PC or other host.
USB	Universal Serial Bus, a serial bus standard used to connect devices.

V-Z

V	Volts.

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